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Regional, Multilateral, and Unilateral Trade Policies of MERCOSUR for Growth and Poverty Reduction in Brazil

Glenn W. Harrison
Thomas F. Rutherford
David G. Tarr
Angelo Gurgel

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Abstract

Harrison, Rutherford, Tarr, and Gurgel estimate that the Free Trade Agreement of the Americas (FTAA), the EU-MERCOSUR agreement, and multilateral trade policy changes will all be beneficial for Brazil. The Brazilian government strategy of *simultaneously* negotiating the FTAA and the EU-MERCOSUR agreement, while supporting multilateral liberalization through the Doha Agenda, will increase the benefits of each of these policies.

The authors estimate that the poorest households typically gain roughly three to four times the average for Brazil from any of the policies considered. This is because the structure of tariff protection in Brazil favors capital-intensive manufacturing. Tariff liberalization in Brazil will shift production toward labor-intensive manufacturing and agriculture. Due to the increase in demand for labor intensive sectors, the wage rate of unskilled labor will increase, and the primary determinant of the impact on the poor from trade liberalization is the wage rate of unskilled labor.

The agreement with the EU is almost twice as valuable for Brazil as the FTAA, but this conclusion depends on the EU providing tariff free access to its agricultural markets as part of the agreement. If the United States and the EU do not permit access to their most highly protected markets, the FTAA will be much more valuable to Brazil than the EU-MERCOSUR agreement. The FTAA contains a large number of markets outside of the United States, so there remains a lot of value in the FTAA for Brazil, even if the United States protects its most highly protected markets.

Both the FTAA and the EU-MERCOSUR agreements are net trade-creating for the countries involved, but excluded countries almost always lose from the agreements. The authors estimate that multilateral trade liberalization of 50 percent in tariffs and export subsidies results in gains to the world more than four times greater than either the FTAA or the EU-MERCOSUR agreement. This shows the continued importance to the world trading community of the multilateral negotiations.

This paper—a product of Trade, Development Research Group—is part of a larger effort in the group to assess the impact of trade liberalization on poverty. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Paulina Flewitt, room MC3-333, telephone 202-473-2724, fax 202-522-1159, email address pflewitt@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. David Tarr may be contacted at dtarr@worldbank.org. May 2003. (56 pages plus 41 pages of appendices)

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Glenn W. Harrison, Thomas F. Rutherford, David G. Tarr and Angelo Gurgel[†]

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Address correspondence to:

David Tarr
World Bank, Room MC3-323
1818 H. Street NW
Washington DC 20433
E-mail: DTARR@WORLDBANK.ORG
Fax: (202) 522-1159

[†] Glenn W. Harrison is Dewey H. Johnson Professor of Economics, University of South Carolina; Thomas F. Rutherford is Associate Professor, University of Colorado; David Tarr is Lead Economist, The World Bank; and Dr. Angelo Gurgel from the Federal University of Vicosa, Brazil.
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Contents

Regional, Multilateral and Unilateral Trade Policies of MERCOSUR for Growth and Poverty Reduction in Brazil

1. Introduction

Regional, multilateral and unilateral trade policy options are all on the table for the government of Brazil. In terms of regional arrangements, Brazil is part of the MERCOSUR customs union along with Argentina, Uruguay and Paraguay. Negotiations to implement the Free Trade Agreement of the Americas (FTAA) with the MERCOSUR countries as members are underway. The most notable bilateral regional arrangement that MERCOSUR is negotiating is a potential free trade agreement with the European Union (EU). Brazil has also supported further multilateral negotiations within the World Trade Organization (WTO).[1] Brazil is a member of the Cairns group supporting agricultural trade liberalization and believes that the best negotiating forum for obtaining freer agricultural markets is the WTO. The WTO agreement to launch the Doha Development Agenda suggests that further multilateral trade liberalization is likely. Finally, although political support for unilateral trade liberalization in Brazil and MERCOSUR may be less evident, each has undertaken considerable unilateral trade liberalization in the last ten years. Several Brazilian scholars[2] have noted a significant increase in Brazilian productivity associated with the trade liberalization, and this has cemented the intellectual support for an open trade regime.

As MERCOSUR considers its trade policy options over the next few years, it would be useful for Brazilian policy-makers to have an assessment of some of the following questions. What is the impact of the FTAA or the potential EU-MERCOSUR free trade agreement? If the EU excludes agricultural products from the agreements, or if the US applies antidumping actions to its most protected sectors, do the agreements lose their attractiveness? What are the potential gains from multilateral liberalization compared with regional liberalization? How can Brazil and MERCOSUR optimally choose the combination of trade policy options? Would the FTAA and the EU-MERCOSUR agreement yield greater benefits taken together than separately? How much would further unilateral liberalization contribute to improved welfare, either independently or in

[1] See the *Trade Policy Review for Brazil* by the World Trade Organization [2000].
[2] For example, Rossi and Ferreira [1999].

combination with regional arrangements? We provide quantitative estimates to answer these and other questions.

It is well known that most results regarding the welfare effects of regional arrangements are typically ambiguous at the theoretical level, and that many questions are quantitative rather than qualitative. Thus we employ a 16-region global computable general equilibrium (CGE) model to quantitatively examine the regional, unilateral and multilateral arrangements. Our model includes the Brazilian economy as well as the economies of Argentina, Uruguay, Chile, Mexico, the United States, Canada, Central America, Venezuela, Colombia, Peru, Rest of Andean Pact, Rest of South America, the EU, Japan and an aggregate Rest of the World. We are therefore able to estimate the impact on partner and excluded countries from each of the agreements we evaluate.

Given the concern about the impact of trade policy changes on the poor, a significant focus of our work is on the impact of the trade policy changes under consideration on the poor. To do so, we incorporate 20 different types of Brazilian households in our model: ten rural and ten urban, where rural and urban households are further classified according to income levels. Our work in this area is innovative most notably in several empirical dimensions, as we describe in Appendices A, C and D. It is only as a result of the careful attention to detail in the empirical work on factor shares and income mapping from the survey data, that we are able to obtain results that can be sensibly used to analyze the poverty dimension of trade policy changes in an applied setting.[3]

Our basic policy results are in Table 5A (in percentage terms) and Table 6A (in U.S. dollars). The results suggest that the regional arrangements under consideration by MERCOSUR, namely the FTAA and an agreement with the EU, can both be expected to result in gains to Brazil. That is, by the standards of preferential trade arrangements, these potential agreements are relatively beneficial (See Harrison, Rutherford and Tarr [2002] and Bakoup and Tarr [2000] for quantitative assessments that find negative impacts of some regional arrangements.) The agreement with the EU is almost twice as valuable as the FTAA due to access to highly protected agricultural markets in the EU. The combined gains from both agreements will be greater than the gains obtained from the sum of the agreements separately due to a reduction of trade diversion. This indicates that the Brazilian strategy of pursuing both agreements, rather than either alone, is beneficial.

[3] We show that the results change considerably without proper attention to detail on the factor shares.

Both the US and the EU, however, may attempt to protect their markets despite a preferential trade agreement. What is the cost to Brazil of denial of preferential market access to the markets of the US or the EU? If the EU excludes it highly protected agricultural products from the EU-MERCOSUR agreement, the gains to Brazil are reduced to only one-ninth of the value of the gains with full preferential market access to the EU. If the US employs antidumping to exclude market access to Brazil for the most protected products in the US, the gains to Brazil would be reduced to two-thirds of the gains Brazil would obtain from full market access in a FTAA. If both agreements are implemented with excluded products, the FTAA will be more valuable to Brazil than the agreement with the EU.

We find that both unilateral tariff cuts in MERCOSUR or tariff uniformity in MERCOSUR also yields benefits for Brazil. We estimate that uniform tariffs in MERCOSUR (such that collected tariff revenue in Brazil is unchanged) would yield benefits even larger than a unilateral 50% tariff cut in MERCOSUR.

In the case of Brazil, we find that most of the trade policy options we evaluate, either regional, multilateral or unilateral, result in a distribution of the gains to the different households that is progressive, so that the poorest households experience the greatest percentage increase in their incomes. This is because trade policy changes in Brazil tend to shift resources from capital intensive manufacturing toward unskilled labor intensive agriculture and manufacturing, thereby inducing an increase in the wage of unskilled labor relative to other factors of production. In general, the oil seeds, other agriculture (excluding grains and wheat), other crops (which includes fruits and vegetables and wheat), processed food and leather sectors expand production and exports, while several manufacturing sectors, including motor vehicles, other metal products and the sector we call manufacturing, decline. This reflects relative protection in Brazil, which favors capital intensive manufacturing at the expense of agriculture and processed food products. When protection is reduced in the economy, resources shift toward the agriculture and food sectors that had been disadvantaged relative to manufacturing. This in turn results in an increase in the incomes of the poorest households in Brazil relative to the richest. The percentage increase in the incomes of the eight poorest households (the four poorest rural and four poorest urban) is several times greater than the percentage increase in the income of the average for the economy as a whole. At a very disaggregate level some poor households could lose, especially in the short run. This emphasizes the need for effective safety net policies to be in place. But given that the sectors that are important to the poor tend to be disfavored by the structure of protection, the medium to long run effects of these trade reforms should be very positive for the poorest households.[4]

Our estimates indicate that the apparent Brazilian strategy of simultaneously pursuing a MERCOSUR agreement with the EU plus the FTAA, while supporting multilateral trade liberalization at the WTO, is well considered. Brazil can optimize its choice of trade policies by combining regional arrangements in both the Americas and the EU with multilateral liberalization. If tariff uniformity is added to the regional and multilateral liberalization, further gains would be realized.

Both the FTAA and the EU-MERCOSUR arrangements are net trade-creating for the countries involved, but excluded countries almost always lose from the agreements. We estimate that multilateral trade liberalization of 50 percent in tariffs and export subsidies results in gains to the world more than four times greater than either the FTAA or the EU-MERCOSUR agreement. This shows the continued importance to the world trading community of the multilateral negotiations.

Our model does not incorporate growth or especially endogenous growth effects of trade policy. Several Brazilian researchers, Feijo and Carvalho [1994]; Bonelli and Fonseca [1998], Moreira [1999], Rossi and Ferreira [1999], Pinheiro and Moreira [2000] and Ferreira and Rossi [2001], have noted a correlation between the opening of Brazil to external trade in the early 1990s and an increase in productivity in Brazilian manufacturing. Recently, Muendler [2001] has been able to infer a causal relationship between the trade liberalization and increase in total factor productivity. This has contributed to the momentum for further trade liberalization in Brazil. A model which incorporated endogenous growth effects, such as that developed in Rutherford and Tarr [2002], would be expected to produce gains from trade liberalization several multiples of the estimated gains of our CRTS model. Numerical endogenous growth models, however, are not yet available that can produce results at the sector or household level such as is required of this analysis. We therefore adopt a more conventional comparative static modeling approach. We believe that in general that we

[4] These results are consistent with two other analyses of the impact of trade liberalization on the poor in Brazil. Barros, Corseuil and Cury [2000]employed a CGE model of Brazil calibrated to 1995 data. They simulated an increase of protection to the levels that prevailed in Brazil in 1985. They find that trade liberalization benefits the economy as a whole, but both the rural and urban poor gain more than proportionately from trade liberalization.

The large study of rural poverty in Brazil by the World Bank [2001, p. iv] concludes that "given that commercial agriculture produces the bulk of Brazil's export crops...a trade policy regime that moves toward relatively low tariffs on importables (of both inputs and final products) could significantly improve the sectors international competitiveness which would in turn lead to greater real wage rates and increased employment opportunities–both farm and downstream processing and transport."

characterize the ranking of the results and the estimated gains to the economy (or losses in some cases) would be a multiple of the gains or losses that we estimate.[5] There are, however, exceptions to this multiple benefits or losses. It is likely that trade (direct and indirect) with technologically advanced countries yields greater increases in productivity than trade with less advanced countries. In this case, the FTAA could provide dynamic benefits for Argentina, for example, even though our estimated static effects are negative.

In Section 2 we describe the model and data. In Section 3 we present and explain the policy results for Brazil, the implications for the distribution of income, and the reallocation of output among sectors. Results for other countries in the model are also explained. The impact on partner and excluded countries of the regional arrangements are also evaluated and compared to the impact under multilateral trade liberalization. In Section 4 we examine how the various trade policy options may be combined to optimize the outcome for Brazil. The conclusions are in Section 5. Appendices may be found on the website: http://dmsweb.moore.sc.edu/Glenn/brazil/.

2. A Multi-Regional Trade Model

A. General Features

The quantitative model developed to evaluate the trade policy options facing Brazil is multi-regional and multi-sectoral. Table 1 lists the 16 regions included explicitly in the model, as well as the 22 sectors included in each region. The model is quite detailed in the Americas: there are 13 countries or regions in the Americas. Outside of the Americas, we have European Union 15, Japan and Rest of the World. This country specification incorporates virtually all the countries or regions that are important to Brazilian trade policy. The general specification of this model follows our earlier multi-regional model of the effects of the Uruguay Round and even more closely our model

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[5] We have evaluated most of the trade policy options in a "comparative steady state" model, similar to our work with a comparative steady state model on the Uruguay Round. But since the rental rate on capital falls in most of our scenarios, the new equilibrium capital stock does not rise, and the estimated welfare gains to the economy do not rise as well. In general, the gains do not necessarily have to increase in a comparative steady state model, as we explain in Rutherford and Tarr [forthcoming, 2003].

Some authors, such as Burfisher, Robinson and Theirfelder [2002], posit Hicks neutral technical change as a function of the share of GDP that is traded, or traded with industrial countries. Although this specification will achieve large welfare estimates from trade liberalization, we choose to avoid this specification since it does not have any microeconomic foundation. It ignores the innovation of the endogenous growth literature regarding technical change.

of the trade policy options for Chile.[6] There are however, several important data and modeling differences between this research and our earlier models. The most important innovation is the extension to multiple households in Brazil. Multiple households in the model for Brazil allows us to assess the distributional impacts of trade policy, not just the aggregate effects. In particular, the impact of trade policy options on the poor can be assessed due to the decomposition of households. Other than Brazil, all economies are modeled in the more traditional manner in which all consumers are represented by a "representative agent."

We employ the "GTAP5 dataset,"[7] but augment or alter the dataset in certain important dimensions to better capture the Brazilian economy. The GTAP 5 dataset employs trade data for 1997 and reconciles the data to be consistent with GDP and other macro data for 1997. With respect to the data for Brazil, we update or modify the GTAP5 dataset in several dimensions. The most important are: we update to the 1996 input-output table of the Brazilian economy, since the GTAP5 database is based on a 1985 input-output table for Brazil; we alter the protection data for Brazil to more closely capture the Brazilian economy (and we correct for some problems in the protection data in some other countries); we use the household expenditure survey for Brazil to construct information on multiple households in Brazil; and we have independently estimated factor shares in Brazilian industries. Key data at the level of productive sectors is described in Table 2. We elaborate on these extensions later and in the Appendices.

We adopt a multi-region model, rather than a small open economy model, since we need to consider the possible effects on Brazil of a reduction in MERCOSUR's import tariffs on partner countries. Crucially, we also need to account for the "market access" effects on Brazilian exports of a reduction of import tariffs by the EU, NAFTA or other regions with which Brazil agrees to a free trade agreement, either separately or collectively.

Although the general theory of the welfare effects of preferential trading arrangements does allow for the impact of changes in partner country tariffs on the home country's terms-of-trade,[8]

[6] Harrison, Rutherford and Tarr [1997c][2002]. Web site HTTP://DMSWEB.BADM.SC.EDU/GLENN/UR_PUB.HTM provides access to the model and related publications.

[7] For documentation see Dimaranan and McDougall [2002].Chapter 4 of this volume describes the contruction of the protection database.

[8] See Wooton [1986] and Harrison, Rutherford and Wooton [1989][1993].

some empirical approaches to evaluating preferential trading arrangements ignore them.[9] Our framework allows us to explicitly evaluate the importance to Brazil of improved market access to regions such as the EU and the Americas, as well as losses Brazil may suffer as partner countries raise export prices to Brazil.

Although there are numerous exceptions to the common external tariff of MERCOSUR, and in many cases it is being phased in over time, we assume that the countries of MERCOSUR apply the common external tariff. Argentina and Uruguay are represented explicitly in our model, while Paraguay is represented as part of the Rest of South America. Thus, we assume that there are zero tariffs on the imports of goods between Argentina, Brazil and Uruguay, and that all three of these countries apply the common external tariff of MERCOSUR. We take the tariff rates of Brazil (from the GTAP5 dataset) as the common external tariff for all countries in MERCOSUR. The MFN tariff rates for all countries in our model are presented in Table 3.

In addition to MERCOSUR, we assume that NAFTA operates as an effective free trade area with zero tariffs among the U.S. Canada and Mexico, but each of the three countries has its own external tariff. Although there are many other regional preferential trading arrangements in the Americas that are implemented at different levels of effectiveness, our dataset does not incorporate these preferential tariff rates. Further notes on the tariff rates in the GTAP5 dataset are presented in Appendix B.

B. Formal Specification

The Model. The general specification of the model follows our earlier work on the Uruguay Round and on Chile. We concentrate here on what we have called our "base" model, which is static and assumes constant returns to scale (CRTS).[10] Apart from the fact that imports and exports are distinguished by many regions and we have many households in the model, the structure of the

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[9] An example is the approach adopted by Bond [1996]. He develops a simple general equilibrium specification of the effects on Chile of these preferential trading arrangements with an impressive level of detail with respect to tariff data. His results for Chile joining NAFTA, however, differ significantly from ours since his CGE model does not incorporate the impact on Chile of access to NAFTA markets.

[10] Given that we extend the multi-country, multi-region framework to multiple households in Brazil, we choose to focus in this paper on CRTS because we believe that is crucial to obtain a clear understanding of the basic mechanisms through which trade policy changes impact on the poor in Brazil. Extentions to IRTS would certainly be of interest, as well as to endogenous growth and investment decisions to the extent feasible as we discussed in the introduction.

model within any country is very close to the basic model of de Melo and Tarr [1992]; the interested reader may consult their chapter 3 for a detailed explanation of the equations.

Briefly, production entails the use of intermediate inputs and primary factors (Labor, Capital and Land). Primary factors are mobile across sectors within a region, but are internationally immobile. We assume Constant Elasticity of Substitution (CES) production functions for value added, and Leontief production functions for intermediates and the value added composite. Output is differentiated between domestic output and exports, but exports are not differentiated by country of destination.

Except for Brazil, each region has a single representative consumer who maximizes utility, as well as a single government agent. In the case of Brazil there are 20 households: ten rural and ten urban. Urban and rural households are distinguished by income levels, as discussed below. In Harrison, Rutherford and Tarr [1997b; Appendix C] we formally characterize the demand structure and elasticities which are critical to the results. Demand is characterized by nested CES utility functions for each agent, which allow multi-stage budgeting. Demand at the top level, for the composite "Armington" aggregate of each of the 22 goods in Table 1, is Cobb-Douglas. Consumers first choose how much of each Armington aggregate good to consume, such as wheat, subject to aggregate incomes and composite prices of the aggregate goods. The initial expenditure shares of each of the 20 consumers determine the elasticity of demand for each of the consumers' demand functions. These expenditure shares (which determine the household demand elasticities) differ across households and are presented in Table 4. The elasticities of demand for each of the The Armington aggregate good is in turn a CES composite of domestic production and aggregate imports. Consumers decide how much to spend on aggregate imports and the domestic good subject to the prior decision of how much income will be spent on this sector, and preferences for aggregate imports and domestic goods are represented by a CES utility function. Finally, consumers decide how to allocate expenditures across imports from the 15 other regions based on their CES utility function for imports from different regions and income allocated to consumption on imports from the previous higher level decision.

Regarding the households in Brazil, although the structure of demand is identical across households, the elasticities of demand with respect to prices differ across Brazilian households. This is because the initial observed expenditure patterns differ across households (see Table 4). Thus, the demand function parameters we solve for, in order to reconcile the observed data with the assumed functional form of the demand functions, differ across households.[11]

Several Brazilian researchers, Feijo and Carvalho [1994]; Bonelli and Fonseca [1998], Moreira [1999], Rossi and Ferreira [1999], Pinheiro and Moreira [2000] and Ferreira and Rossi [2001], have noted a correlation between the opening of Brazil to external trade in the early 1990s and an increase in productivity in Brazilian manufacturing. Recently, Muendler [2001] has been able to infer a causal relationship between the trade liberalization and increase in total factor productivity. established a causal This has contributed to the momentum for further trade liberalization in Brazil. A model which incorporated endogenous growth effects, such as that developed in Rutherford and Tarr [2002], would be expected to produce gains from trade liberalization several multiples of the estimated gains of our CRTS model. Numerical endogenous growth models, however, are not yet available that can produce results at the sector or household level such as is required of this analysis. We therefore adopt a more conventional comparative static modeling approach. We believe that in general that we characterize the ranking of the results and the estimated gains to the economy (or losses in some cases) would be a multiple of the gains or losses that we estimate. There are, however, exceptions to this multiple benefits or losses. It is likely that trade (direct and indirect) with technologically advanced countries yields greater increases in productivity than trade with less advanced countries. In this case, the FTAA could provide dynamic benefits for Argentina, for example, even though our estimated static effects are negative.

Data and Elasticities. Except where we indicate otherwise, we use the GTAP5 database that is current as of November 2001. The 16–region version of the model retains all regions of the GTAP5 database that are directly relevant to our policy simulations. The full GTAP database contains 57 sectors, but we have aggregated to 22 sectors, which results in a model with approximately 2,500 equations. Nonetheless, we have retained the sectors most important to Brazilian trade policy, since we have retained sectors with high protection in either the United

[11] An interesting extension of our analysis would be to allow for non-unitary income elasticities for the different households within Brazil. However, given the way that our demand system is calibrated, using base year expenditure shares, non-unitary income elasticities would have very little impact on the results. The reason is that in the policy simulations we examine the changes in real income are typically on the order of less than 5%. Our judgement is that the extra effort required to calibrate to non-unitary income elasticities would not change our results noticeably, but this judgement should be verified in future work.

States, the European Union or MERCOSUR. Retaining additional sectors would be of interest to analysts of those sectors in Brazil, but as far as the welfare results are concerned, aggregating sectors with similar protection should not significantly affect the results.[12]

The share of value added attributed to capital in an industry is notoriously poorly represented in input-output tables (see Harrison, Rutherford and Tarr [forthcoming, 2003] for details). Consequently, we independently estimated factor shares in Brazilian industries. Details are in Appendix C. Key data on the structure of production from the updated input-output table, our estimated factor shares, and export and import shares, are presented in Table 2. A summary of trade weighted average tariffs by sectors in our model and in the countries of our model is presented in Table 3.

We generally assume that the lower-level elasticity of substitution between imports from different regions, σ_{MM}, is 30 and that the higher-level elasticity between aggregate imports and domestic production, σ_{DM}, is 15. We refer to these values as our central elasticities. There are econometric studies, such as those of Reinert and Roland-Holst [1992] and Shiells and Reinert [1993], that suggest values which are lower than these. However, Reidel [1988] and Athukorala and Reidel [1994] argue that when the model is properly specified the demand elasticities are not statistically different from infinity, and their point estimates are close to the central elasticity values we have chosen.[13] Moreover, elasticities would be expected to increase over time, and this model presumes an adjustment of about 10 years, a rather long period in the context of these econometric estimates.

To be clear, a value of $\sigma_{MM} = 30$ means that if Brazil tried to raise its prices by 1% on world markets relative to an average of aggregate imports, Brazilian imports would decline relative to aggregate imports by 30%. Given that there may be some economists who would prefer lower elasticity estimates, we also perform most of our important policy simulations with $\sigma_{MM} = 8$ and $\sigma_{DM} = 4$. We refer to these as our low elasticities. In our view, a high elasticity scenario, for an economy such as Brazil with little market power on world markets in most products, would be a specification

[12] That is, we aggregated sectors which are not important in trade or which have low rates of protection. It is known that aggregation may significantly change the results in applied trade policy analysis, but that this type of aggregation results in quite small aggregation bias in trade policy analysis. We acknowledge that services is not treated seriously in this model, but the companion work by our colleagues focuses on services Mattoo et al.. [2002].

[13] In addition, the estimates of Schiff and Chang [2003] suggest that the elasticities are high.

with still less market power for exports, such as would occur with in the popular theoretical models of international trade where goods are homogeneous.

The elasticity of transformation between exports and domestic production is assumed to be about 5 for each sector. Elasticities of substitution between primary factors of production is unity. We assume fixed coefficients between all intermediates and value added.

Distortions. All distortions are represented as *ad valorem* price-wedges. Border protection estimates combine tariff protection and the tariff equivalents of non-tariff barriers.

In Appendix B we explain in detail how we modified the GTAP5 data on protection to better reflect the Brazilian structure of protection. Appendix B shows that, outside of services, the GTAP tariff levels closely reflect the legal MFN rates of the common external tariff of MERCOSUR at the level of GTAP product categories. In addition, when we average over all commodities, both the legal common external tariff of MERCOSUR on a most favored nation (MFN) basis and the GTAP collected tariff rate for countries outside of MERCOSUR are between 12% and 13%. In services, however, the GTAP dataset contains both significant subsidies to imports in some services sectors and significant tariffs on other services imports. We judge neither to be reasonable, and impose zero tariffs on services in our tariff database for Brazil (and for other countries as well). In addition, contrary to the GTAP database, we impose zero tariffs on imports within MERCOSUR. After these corrections, the implied collected tariff in the corrected GTAP database is 9.2%, which is slightly larger than the actual collected tariff average in Brazil of about 8%.[14] Remaining differences in the collected rates reflect preferential arrangements not incorporated in the GTAP database and exemptions to the tariff such as duty drawback. We conclude that our MFN rates for Brazil are accurate and the collected rates are close to actual collected rates.

We employ the GTAP tariff rates for countries outside of Brazil as well. These tariff rates are trade weighted average tariffs, and consequently typically differ according to trading partner. That is, since there are thousands of tariff lines in the tariff schedules of most countries, literally hundreds of tariff lines must be mapped into a single sector in the GTAP database. Since the product mix of imports differs across countries, the trade weighted average tariff rate will differ

[14] Collected tariff information was obtained from both the Brazilian Ministry of Finance and the Ministry of Development, Industry and International Trade.

according to the country of origin.[15] It is possible to observe from Table 3 that agricultural protection in the EU (and Japan) is relatively high, and this will play an important role in the analysis. Although we impose the CET of Brazil for the external tariff of Argentina and Uruguay, the trade weighted average tariff across all countries is not precisely equal in all cases for the three countries because of product mix differences across sources of imports.

Other distortions include factor taxes in production, value-added taxes, export subsidies (especially on agricultural exports from the EU, but to a limited extent elsewhere), and export taxes on textiles and apparel.[16] It is generally believed that rents under the multi-fiber arrangement are captured by exporters, so these are represented as *ad valorem* export tax equivalents. In the case of Brazil, the export taxes on textiles and wearing apparel are estimated to be four percent. Lump-sum replacement taxes or subsidies ensure that government revenue in each region stays constant at real benchmark levels.

Brazilian Households. Household expenditure and income patterns were extracted from the Living Standards Measurement Survey (LSMS) for Brazil. This survey was designed and conducted by Instituto Brasileiro de Geografia e Estatística (IBGE). The LSMS survey is a stratified sample, where each household samples represents a share of the total population in the area sampled. The LSMS focused on the eastern part of Brazil, but it is estimated to represent 103.6 million people in this region, 22.3 million rural people and 81.3 million urban people. This constitutes about 63% of the total population. Although much of the country is not sampled in the LSMS, experts who have worked with the poverty data in Brazil believe the poor overall are represented proportionally in the sample, at least not under represented.[17] We calculate the Gini coefficient for the entire survey sample at 0.585 and we present Lorenz curves for the rural and urban populations in our sample in Figure 1.

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[15] Take the GTAP category motor vehicles and parts in Brazil as an example. Imports of motor vehicles are subject to a tariff of 35%. But motor vehicle parts, and tractors are typically subject to a tariff of 22% or lower. If country A exports mostly parts to Brazil, its weighted average tariff rate will not exceed 22%. If country B exports mostly cars to Brazil its weighted average tariff on its exports to Brazil will be about 35%.

[16] The Uruguay Round made a great deal of progress in eliminating non-tariff barriers to trade, especially in agriculture. The multi-fibre arrangement, however, is one example of non-tariff barriers that remain. We assume that the non-tariff barriers are not changed by the trade policies under consideration.

[17] We thank Peter Lanjouw and Francisco Ferreira for helpful conversations on several aspects of assessing poverty in Brazil.

We aggregated the approximately 5000 Brazilian households in the survey into twenty households, ten urban and ten rural. Within rural and urban households, households were classified according to *household* income from poorest to richest. Key characteristics of the households in the LSMS survey are listed in Table 1.

The shares of income each household spent on each commodity group was extracted from the LSMS. In addition, the shares of income each household obtained from capital, rent on land, unskilled wages and skilled wages was extracted from the LSMS. The results of this work is presented in Table 4 and the details are explained in Appendix D.

A natural question to ask is what percentage of the households are poor, based on the LSMS. Poverty lines are defined in several ways. Two well known measures are one dollar per day per person or two dollars per day per person at a purchasing power parity exchange rate. Based on the LSMS data, we calculate that 7.3% of the population lives on one dollar per day or less, and 17.8% of the population lives on two dollars per day or less. In order to calculate poverty in Brazil, Ferreira, Lanjouw and Neri [1999] have developed a measure of poverty that equals the "minimum food basket" in the reference region, metropolitan Sao Paulo, that would generate the FAO minimum coloric intake of 2,288 calories per day. They have also developed indices that allow them to define "equivalent" income levels across the individual households in different regions of the LSMS. We estimate that this measure (which is the lowest of the three measures Freerira et al. develop) amounts to $1.50 per capita per day, using our purchasing power parity adjustments for 1996.[18] Using the poverty headcounts for each region in Brazil, reported in Ferreira, Lanjouw and Neri [1999; Table 3], and sample weights for the individuals in each of the regions of the LSMS in Brazil, their measure implies a national poverty index of 13.03% for Brazil using the LSMS.[19]

Based on the Ferreira, Lanjouw and Neri [1999] measure of poverty incidence, we estimate that 13% of individuals in Brazil are below the poverty line. We calculate that 82% of the

[18] Specifically, they report an indigence poverty level of 65.07 Reals per month. This is divided by 30.417, the average number of days in a month, and then divided further by 1.44 to get the PPP-equivalent in U.S. dollars. This is $1.48656, which we round to $1.50 for ease of recollection.

[19] They also report comparable numbers from an alternative survey, known as the PPD, which imply a national poverty index of 24.7% using comparable income measures. Ferreira, Lanjouw and Neri [1999; p.13] note some important differences which could account for the higher poverty index derived from the PPD: unlike the LSMS, it only asks about one aggregate non-wage source of income, using a single question, despite the considerable heterogeneity of non-wage sources of income. They also note that there may be measurement errors associated with the way in which the wage income question is asked, particularly since the same form of the question is applied to employees of firms and self-employed individuals.

households in our poorest two, Uhhd1 and Rhhd1, fall below this poverty line. Some individuals in household two or three may be poorer than individuals in household 1, because they belong to large families and the groups are defined by household income not per capita income.[20]

Solution Algorithm. The model is formulated using the GAMS-MPSGE software developed by Rutherford [1999] and solved using the PATH algorithm of Ferris and Munson [2000]. Although the model has 16 regions and 22 sectors, and is large by historical standards, it is smaller than our Uruguay Round model. Use of demand elasticities as high as those we employ could pose numerical problems in general, but this model solved without difficulty. Details on the software needed to replicate and extend our model are provided in Appendix E.

3. Policy Results

We first discuss how Brazil and all other countries in our model will be impacted at the aggregate level from its various trade policy options. We report the change in welfare in our model as a percent of consumption[21] and in 1996 US dollars. The change in welfare is the "Hicksian equivalent variation," which in less technical terms can be thought of as the change in real income. Our aggregate estimate for the change in welfare is the sum of the welfare changes for the twenty individual households in our model. We emphasize our central elasticity results, but also present results for low elasticities,[22] along with results for the impact on the real exchange rate and the percentage change in government revenue resulting from the tariff reductions. Subsequently, we present the results of our model of the Brazilian production sectors, with estimates of the impact on prices, output, imports and exports. Finally, we examine the impact of the trade policy options on the multiple households with a focus on the poor.

[20] In subsequent work we intend to investigate the impact of defining our households such that the *individuals* on the first household earn less than one dollar per day, individuals in the second earn between $1 and $1.49, and those in the third household earn between $1.50 and $1.99. This would allow a more detailed estimate of poverty impacts according to different measure. On the other hand, the model results are generally quite uniform for the poorest households, so the main policy conclusions with respect to the effect of poverty would not change.

[21] Welfare as a percent of GDP would be about 70% of our estimate of welfare as a percent of consumption.

[22] Systematic sensitivity analysis of the effect of uncertainty about key elasticity estimates on our main results is currently underway, using the methods of Harrison and Vinod [1993] and Harrison, Jones, Kimbell and Wigle [1992]. Those results will be reported later. Preliminary results indicate that the conclusions we rely on here are qualitatively very robust.

A. Aggregate Results for Brazil and Other Countries

The overall welfare results for the trade policy options of MERCOSUR are presented in Table 5A for central elasticities (low elasticity results are in Table 5B). Welfare impacts in these tables are presented as a percent of personalconsumption of the respective country or region. They represent changes on a recurring, annual basis, so a 1% welfare gain should be interpreted as a 1% increase in real income *each year in the future*. In Tables 6A and 6B we present results for the same scenarios in 1996 US dollars. In Table 7 we present the impact on macroeconomic variables in Brazil as a result of these trade policy options.

Free Trade Agreement of the Americas. In this scenario we assume that all countries in the Americas agree to offer tariff free access on all products reciprocally, while their external tariffs on countries outside of the Americas are not affected by the FTAA. The results for the FTAA with central elasticities are presented in the first column of Table 5A. We estimate that Brazil will gain from the FTAA by about six-tenths of a percent of Brazilian personal consumption (or from Table 6A, about US $3 billion).

The impact of regional trade arrangements is often discussed using the concepts of trade diversion and trade creation. Regional trade arrangements can produce negative welfare results on participating countries, since it is possible that trade is diverted away from more efficient low cost trading partners who are excluded from the agreement toward imports from members of the free trade agreement which are not subject to a tariff. This is known as trade diversion. Trade creation occurs when the partner country is the most efficient supplier of the product on world markets, so even though tariffs are lowered only preferentially, the result is nonetheless an increase in imports from the most efficient supplier in the world. When the agreement is with small countries only, the lack of competition among members of the agreement can lead to a significant increase in the cost of imports for member countries, i.e., trade diversion. In the case of the FTAA, the agreement includes a very large economic area. For most products, there are suppliers within the Americas who are either the most efficient supplier of the product on world markets or else they are close to the most efficient supplier. Moreover, competition among the many countries and suppliers prevents the supply price for imports from partner countries from rising significantly.

For these reasons, we estimate that Brazil and most countries in the Americas will gain from a FTAA. The one exception to this pattern in the Americas is Argentina, which we estimate to lose slightly from the FTAA. The reason Argentina is estimated to lose from the FTAA is that prior to the FTAA, it enjoys preferential access to the markets of the other MERCOSUR countries. The FTAA provides equivalent access to the other countries in the Americas to the MERCOSUR markets, thereby eroding the preferential access of Argentina. The loss of preferential access for Argentina, combined with trade diversion effects, are larger than the trade creation effects.

On the other hand, countries that are excluded from the agreement (the EU, Japan and Rest of the World) all lose as a result of the FTAA. Their combined loss is $8.4 billion. The reason is that the excluded countries suffer a decline in demand for their exports to the Americas as importers in the Americas shift demand toward suppliers from the Americas. The EU is estimated to lose $2.6 billion, slightly more than the $2.3 billion the United States is estimated to gain.

From Table 7 we see that the estimated loss of tariff revenue is about six-tenths of one percent of GDP. This is over half of the tariff revenue available in the benchmark equilibrium The Brazilian authorities will have to be cognizant of the need to replace the tariff revenue with alternate taxes so as not to contribute to the fiscal deficit. We estimate that the real exchange rate will depreciate as a result of the FTAA by about 2.6%. In general, the reduction in home country (MERCOSUR) tariffs leads to an increase in the demand for imports. The real exchange rate in MERCOSUR countries has to depreciate to restore equilibrium in the balance of trade. A real depreciation results in an increase in the supply of foreign exchange from exports and a decrease the demand for foreign exchange from imports, which together restore equilibrium in the balance of trade. Mitigating against the real exchange rate depreciation is the improved access or terms of trade improvement in the markets of partner countries. Improved terms of trade in partner markets results in an increase in the supply of foreign exchange and induces an appreciation in the real exchange rate. On balance, the tariff reduction dominates our assessment of the impact on the real exchange rate.

European Union-MERCOSUR agreement. In this scenario we assume that MERCOSUR and the EU agree to offer tariff free access to all their markets reciprocally. In column 3 of Tables 5A and 6A we present our central elasticity estimates of the impact of a free trade agreement between MERCOSUR and the EU, in percent of consumption and US dollars, respectively (low elasticity estimates are in Tables 5B and 6B).

The gains to Brazil from a MERCOSUR agreement with the EU are about 1.5 times the gains from a FTAA. The gains to Argentina and Uruguay are dramatically larger than with the FTAA. The reason for this can be seen from Table 3: the EU has several agricultural and food products with very high tariffs. If Brazil, Argentina and Uruguay could obtain tariff free access to these EU markets, while the EU continues to apply these tariffs on other countries, they would obtain a very large terms of trade gain in EU markets. In the case of the relatively small economy of Uruguay, the large increase in prices available in the EU induces a large shift of exports toward the EU to take advantage of the increase in prices.

As with the FTAA, countries excluded from the agreement typically lose due to the shift in demand toward partner country suppliers. One exception is Japan. As the EU and MERCOSUR countries shift toward the markets of each other, Japan obtains a small terms of trade improvement in the markets of the Rest of the World. The gains to Japan, however, are very small, and round to zero at the nearest one-tenth of a percent of Japan's consumption.

Excluded Products in the EU-MERCOSUR Agreement. Some would argue that MERCOSUR will have great difficulty negotiating an agreement with the EU in which the EU would grant tariff free access in its highly protected agricultural products. The EU has steadfastly refused to do so in its Association Agreements with the Central and Eastern European countries, in its customs union agreement with Turkey, and in its free trade area agreements with various Mediterranean countries such as Morocco and Tunisia. Hence it is unlikely to offer concessions to MERCOSUR that it has refused to offer to other countries for which it might be viewed as having more to gain geo-politically. What is the cost to Brazil of denial of full market access in a MERCOSUR-EU agreement? In this scenario we assume that the EU fails to provide improved market access to its highly protected products. These products and the tariff rates in the EU in our data set are: paddy rice (65%), cereal grains (44%), processed rice (86%), other food products (28%), bovine meat products (95%), dairy products (90%), other meat products (61%) and sugar (76%).

The central elasticity results are presented in Tables 5A and 6A. For Brazil we see that if the EU fails to provide full market access, the value of the EU-MERCOSUR agreement is reduced to one-tenth of a percent of consumption from nine-tenths of a percent, i.e., the agreement contains very little value. The estimated gains for Uruguay are reduced dramatically. The highly protected agriculture and food product markets in the EU are products in which the MERCOSUR countries have a comparative advantage. Consequently, if the free trade agreement between the EU and MERCOSUR excludes these products, the expected benefits would be significantly reduced. These results demonstrate the importance of improved access in preferential trade agreements, emphasized by Wonnacott and Wonnacott [1981]. In addition, the gains to the EU are reduced from 0.5% of its consumption to 0.1%, reflecting the importance of agriculture liberalization in the EU for the EU to reap gains.

Excluded Products in the FTAA (by the United States against Brazil). There is also a potential for excluded products in the FTAA, although the exclusion is likely to be implicit rather than explicit. Despite a proposal by Chile to limit the use of antidumping actions as part of the FTAA, the US has heretofore strongly resisted efforts to limit the use of antidumping actions as part of the FTAA. In addition, the Brazilian authorities have expressed the fear that the benefits of improved access to the markets of the US will be denied by antidumping actions. In this scenario we provide an estimate of the costs to Brazil of continued US protection of its most protected markets even if a FTAA is implemented. We focus on the most highly protected products in the US market: oil seeds (18%), other crops (14%),[23] dairy products (42%) and sugar (53%). In this scenario we assume that on the most sensitive and highly protected products in the US, the US employs antidumping duties to neutralize the impact of the FTAA on the exports of Brazil. That is, the US tariff applied on exports from Brazil of these products does not change in the counterfactual when we implement the FTAA with excluded products in the US. This is not a full treatment of the potential use of antidumping within the FTAA or of the impact on Brazil. Such a treatment would have to account for antidumping duties by the US against other partners in the Americas as well, and the use of antidumping by countries other than the US. Moreover, antidumping in sectors such as steel, limits access for Brazilian exports relative to the MFN tariff rates we employ. But this scenario should provide an assessment of the *potential* costs to Brazil of US antidumping.

[23] Our category other crops is an aggregate of the following sectors from the full GTAP dataset: wheat, vegetables and fruits, fiber based plants, wool, forestry, fishing and the category other crops. We have also performed simulations with wheat as part of grains rather than other crops. Argentina gains more from the EU-MERCOSUR agreement, but otherwise most of the results change by extremely small amounts.

The impact of excluded products in the US is to reduce the benefits to Brazil to about two-thirds of the gains Brazil would receive with full market access in a FTAA. The reduction in benefits from denied market access in the US is not as severe as the impact of excluded products with the EU agreement. There are two principal reasons why denial of market access is more important in the agreement with the EU. First, the tariff peaks in the United States market are not as high as the tariff peaks in the EU. The large impacts tend to be driven by the tariff peaks, so the impact of excluding the tariff peak products in the EU is very large. Second, there are other markets in the Americas that open up to Brazil as part of the FTAA. If the US fails to provide preferential access to its highly protected products, Brazil may sell these products in the other markets of the Americas since, in the FTAA, Brazil obtains preferential access to these markets compared to countries outside the Americas. On the other hand, if the EU denies preferential access as part of a free trade agreement between Brazil and the EU, there are no alternate markets in which Brazil has preferential access for these products as part of the agreement.

Combining the Free Trade Agreement of the Americas with the MERCOSUR-EU Agreement. Some authorities in Brazil have expressed a desire for an agreement with the EU to come into effect together with the FTAA. Our results, in Tables 5A, 5B, 6A and 6B, indicate that the benefits to Brazil from the two agreements together exceed the sum of the benefits for each of the agreements separately. This is because the combined economic area of the Americas plus the EU is rather vast, and Brazil is more likely to find the most efficient world supplier in this combined economic area than in either region separately. That is, the trade diversion effects that are part of either agreement separately are reduced by combining the two agreements. Thus, the strategy of negotiating an agreement with the EU in addition to the FTAA appears to be a useful strategy that is likely to increase the welfare gains to Brazil.[24]

Unilateral Trade Liberalization by 50 Percent. We estimate that a 50% cut in the tariffs of MERCOSUR will result in an increase in welfare by about four-tenths of a percent of Brazilian consumption, or about $1.9 billion per year. Thus, the gains from the FTAA with excluded access to

[24] These results are similar to the results Harrison, Rutherford and Tarr [2002] found for Chile when they found that the "additive regionalism" strategy of Chile resulted in significantly larger benefits than the agreements taken separately.

the US market on selected products results in approximately the same gains as a unilateral tariff cut by MERCOSUR of 50%.

Multilateral Trade Liberalization. Brazilian authorities have also encouraged multilateral trade negotiations, and supported the Doha Development Agenda. In part, this is due to the view that the most likely venue in which agricultural liberalization (which is important to Brazil) will take place is through the World Trade Organization. We consider a scenario in which all countries in the world reduce their tariffs and export subsidies and taxes by 50%.

Brazil gains about eight tenths of a percent of personal consumption from multilateral trade liberalization in our static model, or about $4.5 billion. This is larger than the gains from the FTAA and larger than the gains from an agreement with the EU that excludes the highly protected agricultural and food products. Given the likely exclusion of agriculture from a MERCOSUR agreement with the EU, these results support the strategy of the Brazilian authorities that it is important to pursue multilateral liberalization together with the regional options. In fact, it is most important.

FTAA with no change in the external tariffs of MERCOSUR. We can also evaluate the impact of the Free Trade Agreement of the Americas in which no improved access to the markets of MERCOSUR is offered. That is, in this scenario we assume that the countries in the Americas outside of MERCOSUR lower their tariffs preferentially to all countries in the Americas (so Brazil obtains improved market access), but the countries in MERCOSUR do not lower MERCOSUR tariffs against the partner countries in the Americas (so Brazil does not offer any improved market access). The purpose of this scenario is to assess how much of the gains to Brazil will come from improved market access to the markets of the Americas and how much is due to lowering the tariffs of MERCOSUR, thereby achieving improved resource allocation in Brazil. One could imagine active use of antidumping policy in Brazil and Argentina that denies improved access to the countries of the Americas. This is analogous to our scenario above in which we assumed the FTAA was implemented but the United States failed to provide improved market access to Brazil through the use of antidumping.

In column (8) of table 5A we see that the gains to Brazil are reduced to 0.4 percent of consumption, i.e., about two-thirds of the gains remain. This shows that improved market access in responsible for about two-thirds of the gains to Brazil from the FTAA; the remaining one-third of the gains comes from the lowering of the MERCOSUR tariff preferentially. From Tables 8A and 9A, however, we see that the gains to the poorest households are reduced much more dramatically. That is, poor households gain much more from the reduction in MERCOSUR tariffs in the FTAA than from improved market access. We explain why below.

Impact on Partner and Excluded Countries–Comparison with Multilateral Liberalization. Experience with regional trade arrangements has shown that if the agreement is not mutually beneficial to all parties, then it is unlikely to be effectively implemented or sustained (World Bank [2000]). Agreements may exist *de facto*, but are not implemented effectively. Thus the impact of the FTAA or EU-MERCOSUR on Brazil's partner countries in the trade agreements is relevant to the likely success of the agreements in the long run. Moreover, even if the agreements are beneficial to Brazil and its partners, if the benefits are derived from losses to countries that are excluded from the agreements, then clearly the agreements would be unattractive from the perspective of the multilateral trading system. Thus, it is important to estimate the impact on partner and excluded countries as well. We compare the results to multilateral trade liberalization of 50% tariff and export subsidy cuts. In order to be able to compare gains and losses across countries, in Table 6A and 6B we add the dollar estimates across countries to arrive at a sum for countries included in the agreement or a sum for those excluded from the agreements.

All the agreements considered result in net benefits for virtually all the included countries.[25] These agreements are roughly all trade creating agreements. This reflects the fact that all the agreements create large economic areas, where it may be expected that competition prevails for most products and the most efficient suppliers are likely to be close to the most efficient in the world.

Regarding excluded countries, virtually all excluded countries lose from regional agreements (the impact on Japan of EU-MERCOSUR is an exception for the reasons mentioned above).[26] The agreements are sufficiently trade creating, however, that these agreements generate gains to the world as a whole. For the world as a whole, we estimate that multilateral liberalization generates

[25] Argentina loses slightly from the FTAA in our central elasticity case dur to the erosion of preferential access in the MERCOSUR markets. Using the GTAP dataset and modeling software, Cardoso Teixera [2002] and Lia Valls Pereira [1999] also found that Argentina loses and Brazil gains from the FTAA

[26] Losses appear for most countries reported to have zero welfare change when the data are reported to an additional decimal place.

gains to the world of more than four times the gains from the best of the regional arrangements we consider. This emphasizes the importance to the world trading community of multilateral negotiations.

B. Impact on Production Sectors: Changes in Output, Price, Imports and Exports

In Tables 10A (and 10B for low elasticities) we present the estimates of the impacts on production sectors as a results of the trade policy options. The percentage change in output, exports, imports and the consumer price in Brazil are presented. Although the impact on the sectors depends on the specific agreement, there is a pattern. In general, the oil seeds, other agriculture (excluding grains and wheat), other crops (which includes fruits and vegetables and wheat), processed food and leather sectors expand production and exports, while several manufacturing sectors, including motor vehicles, other metal products and the sector we call manufacturing, decline. This reflects relative protection in Brazil, which favors manufacturing at the expense of agriculture and processed food products. When protection is reduced in the economy, resources shift toward the agriculture and food sectors that had been disadvantaged relative to manufacturing. We also note that the expanding sectors tend to be less capital intensive than the contracting sectors, and this has implications for the impact on the poor.

The reduction in tariffs generally depreciates the real exchange rate (see Table 7 for estimates); this is because the increased demand for imports accompanying the decline in tariffs induces and increase in the price of foreign exchange. *The depreciation of the real exchange rate encourages exports* and mutes the import expansion. *The depreciated real exchange rate results in the export sectors having an increased incentive to export even if the tariffs in the export markets are unchanged.* This is one of the primary reasons that international trade economists say that an import tariff is equivalent to a tax on exports. Given our view that Brazil will neither give nor receive a "free lunch" from the rest of the world in the long run, we assume that there must be an increase in the value of exports to match the increase in the value of imports accompanying tariff reduction. The real exchange rate is the principal variable that induces the equilibrium between the change in imports and exports.

At the sector level, we see that the export expansion is rather broad in the FTAA and the multilateral and unilateral scenarios. The biggest export expansion comes from the sectors that are expanding production, namely the sectors that received relatively little protection initially. The combined export expansion from the sectors expanding exports must offset the increased in imports plus the decline in exports from the few manufacturing sectors that contract exports. Since (from Table 2) we see that the manufacturing sector was the most export intensive sector in Brazil among the sectors of our model (at 29% of the value of domestic output); and manufacturing has the highest value of initial exports, the export expansion in other sectors must be more substantial.

Different agreements have disparate impacts on different sectors. The EU-MERCOSUR agreement could induce an enormous percentage increase in agriculture and food exports. Exports of the products highly protected in the EU are estimated to expand from 63% (grains) to several multiples of the current level of exports in the case of bovine meat products. However, if the EU excludes the highly protected agriculture and food products from the agreement then the expansion of exports of these products would be very modest.

In Table 10B, the results for the low elasticity scenario is presented. In general, as expected from economic theory, the impact on the sectors is muted with lower elasticities.

Multilateral trade liberalization is also estimated to have a positive impact on agriculture and food exports, and has a strong impact on reducing agriculture and food imports. The reduction in imports of these products is explained by the fact we assume that export subsidies (mostly relevant in the EU) are also reduced by 50% with multilateral trade liberalization.

The FTAA is estimated to lead to a substantial expansion of the leather sector, but also of the sugar sector. Exports of these products plus oil seeds and "other crops" expand significantly with the FTAA even if we assume that the US excludes Brazilian access to its most highly protected markets.[27]

C. Impact on Households and the Poor

Although we have seen that the trade policy changes under consideration are generally beneficial for the Brazilian economy as a whole, in this section we present our estimates and explanations of the impact of the trade policy changes on the different households in Brazil. We focus especially on the impact on poor households.

In our model we have twenty households in Brazil: ten rural and ten urban, grouped according to income. In Tables 8A and 8B we present the results on the households in percentage terms and in Tables 9A and 9B we present the impacts in terms of US dollars. Consider the FTAA

[27] Burfisher et al. [2002] found only small increases in agricultural imports in the US as a result of the FTAA.

as an example. With central elasticities, we can see from Table 8A that while the overall impact is an increase in Brazilian welfare by six-tenths of a percent of consumption, the impact on the poorest rural and urban household is an increase in welfare by about four times this amount: that is, an increase of 2.5 percent of the value of household consumption. For the basic seven scenarios considered in Tables 8A and 8B, we estimate that the poorest household will typically gain several multiples of the aggregate gains for the economy expressed as a percent of household consumption.

Although the impact on the income of households is not strictly progressive, the four poorest urban households and four poorest rural households are among the biggest gainers from the reforms as a percent of their own household consumption.[28] The reason for this result, as shown in Table 4, is that the poorest households earn the majority of their income from unskilled labor and the wage rate of unskilled labor increases significantly more that the skilled labor wage rate and the rent on capital (see Table 7). The poor typically do not have significant real assets or financial assets accumulated so they do not earn significant capital income or income from the rent of land. Nor do the poor typically have much human capital accumulated, so they earn a much smaller share of their income from skilled labor that the middle income classes. Although these facts are intuitive, they are documented in Appendix D based on the Brazilian LSMS.

The value of land rises even more than the wage rate of unskilled labor. As a result of their land ownership, two of the richest rural households are the biggest gainers from the reforms.

To document this interpretation, we decompose the impact of the FTAA on households and present the results in Table 11. In column (1) we reproduce the base results from Table 8A for the FTAA. In column (2) we counterfactually assume that all households consume the commodities in the same proportions. We observe that while the gains to the poorest households are slightly reduced compared to the total for the economy, the percentage gains in household income of the poorest households remain between three to four times the percentage gains for all households together. Thus, disparate consumption shares do not explain why the poor households gain more from the trade policy changes. On the other hand, in column (3) we present the results of our FTAA

[28] The Gini coefficient does improve with the main policy scenarios we are considering. For example, it changes from 0.5850 in our benchmark to 0.5826 in scenario FTAA. For reasons explained in Harrison, Rutherford and Tarr [2001], however, we caution against use of simple measures of inequality such as the Gini when the concern is really with the impact on the poor. It is quite possible, as illustrated there, for the Gini to indicate an improvement in the distribution of welfare (an improvement being defined as a more egalitarian distribution) while poverty increases. There are ways to modify the Gini to give greater weight to the poor, but we prefer to utilize the detailed results from the simulations directly rather than debate the virtues of alternative summary statistics.

scenario where we counterfactually assume that all households earn their income from the factors of production in the same proportions. That is, we ignore the data in Table 4 from the LSMS as to how the different households earn their income. Instead we assume that all households earn the same share of their income from the wages of unskilled labor, wages of skilled labor, rent on capital, and rent on land. We see in column (3) that most of the poorest households would only obtain a slightly greater increase in income compared to the average of six-tenths of a percent if they earned their income in the same manner as the average for the economy as a whole. This confirms that what is critical for explaining why poor households are estimated to gain more from the trade policy options is that the price of the factors of production important to the income of the poor households rise more than proportionately. From Table 4 we see that the factor most important to the poor is the wage rate of unskilled labor. Data in Table 7 show that the unskilled labor wage rate rises the fastest among the important household income factors.

Why do we estimate that the wage rate of unskilled labor rises the fastest among the factors of production (except for land)? International trade theory argues that, following trade liberalization, the price of the factor of production used intensively in the protected sector should fall relative to the price of the factor of production in the unprotected sector.[29] In countries where unskilled labor is relatively abundant (as in most developing countries), the country has a comparative advantage in the goods that use unskilled labor intensively, and these countries often protect the capital intensive sectors which can't compete in open competition on world markets. Trade liberalization would therefore move resources from the capital intensive sectors to the unskilled labor intensive sectors, and would be expected to increase the wage rate of unskilled labor. This is precisely what happens in our trade policy scenarios for Brazil. Sectors such as motor vehicles, other metal products, and other manufacturing, which are among the most capital intensive sectors in Brazil, are the sectors that decline. On the other hand, it is the key agriculture sectors that, due to export expansion, are expanding output. And these sectors are the most intensive in unskilled labor in our data.

To further verify this explanation, we perform one additional simulation in column (4) of Table 11. As explained in appendix C, input-output tables notoriously provide inaccurate information about factor shares.[30] In particular, the capital intensity estimates for agriculture are

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[29] This is known as the Stolper-Samuelson theorem.

[30] Researchers at the International Food Research Institute such as Arndt et al [1998], Thomas and Bautista [1999] and Hausner [1999] have noted this problem.

often strongly biased upward. Thus, we estimated factor shares from additional information not in the Brazilian input-output table and presented those estimates in Table 2. In column (4) of Table 11 we present the estimated percentage welfare gains from the FTAA to Brazilian households if we use the biased factor shares available in the original GTAP data. The results show that if we use the uncorrected factor shares in the GTAP dataset, there is a dramatic difference in the results. The poorest rural (urban) household is estimated to gain five-tenths (four-tenths) of a percent of its consumption, equal or slightly less than the aggregate average percentage gain. This shows that the corrections we performed to the factor share data are crucial to the results at the level of the household and supports the interpretation that the shift of resources toward agriculture is important in increasing the incomes of the poor and reducing poverty.

Our results also show (in column (8) of Tables 5, 6, 8 and 9) that internal resource reallocation is relatively more important to the poor than improved market access. As explained above, in this scenario, MERCOSUR does not change its own tariffs but obtains improved market access to the markets of the Americas. The gains to the economy on average fall by about one-third compared to the FTAA, but the gains to the poorest households fall by two-thirds. This is because it is internal resource reallocation that increases the unskilled wages relative to other factor prices, not improved market access. With only improved market access, the poor gain, but not progressively as they do with internal liberalization in MERCOSUR.

Although we find that the reforms are significantly pro-poor, our model implicitly assumes a time long enough to re-establish equilibrium after some policy shock. Thus, it is possible that during the transition to a new equilibrium some poor households will be hurt. This is especially likely among the households that are moving out of the declining sectors, such as the more highly protected manufacturing sectors. This emphasizes the need to have an effective safety net in place to assist the poor.

At a methodological level, these decompositions of the source of changes in welfare across households represent a general equilibrium analogue, and extension, of the type of factor decompositions of the source of inequality proposed by Shorrocks [1982]. His decompositions allowed an exact identification of the contribution from each of the *factor* components of *factor* income, assuming that those factor components added up to factor income for each of the units of analysis. Our approach considers the (aggregate) factor-income contribution to welfare changes as well as the expenditure-pattern contribution.

4. Optimizing Brazilian Trade Policy

In this section we assume that the most likely outcome of negotiations with the EU is that the EU will exclude the highly protected agricultural products from the agreement with MERCOSUR, and that the United States will continue to apply antidumping actions against nations in the Americas, even with a FTAA. Given that these agreements are likely to have what we refer to as "excluded products," how can Brazil combine various policies to optimize its trade policy, or more precisely optimize the trade policy of MERCOSUR? In Table 12 we present five scenarios that represent combinations of policies to evaluate the impacts.

FTAA with excluded products in the US and 50% unilateral MERCOSUR tariff cuts. In column (1) we evaluate the impact of MERCOSUR unilaterally lowering its tariffs by 50% across the board ***in combination*** with the FTAA with excluded products in the US. In our analysis, excluded products in the US means that US antidumping policy denies access to Brazilian exports in the highly protected products in the US of oil seeds, other crops, dairy products and sugar. The estimated gains to Brazil are 0.72% of Brazilian consumption. Compare this outcome to column (2) of Table 5A, where Brazil gains only four-tenths of a percent of Brazilian consumption with the FTAA and excluded products. By unilaterally lowering the common external tariff of MERCOSUR, Brazil, Uruguay and Argentina reduce the trade diversion costs of the FTAA, while retaining preferred access to the markets of the Americas. In addition, there are improved resources allocation effects from the lowering of the tariff in MERCOSUR, independent of the regional impacts. Thus, the gains for all three countries from an FTAA with excluded products in the United States would increase with a 50% across the board cut in tariffs unilaterally. In the case of Argentina, the welfare effects go from being negative to being positive (not shown in the Table).

Combining the Free Trade Agreement of the Americas with the MERCOSUR-EU Agreement with Excluded Products. A combination of the FTAA and the MERCOSUR agreement with the EU may be subject to the exclusions of agriculture and food products for the EU and the antidumping neutralization in the FTAA for the reasons discussed in Section 3. Thus, we also estimate the welfare impact on Brazil and other countries of the combined effect of these agreements with the same exclusions discussed above for the agreements separately. The impact on Brazil is that the gains from the combined agreements with excluded products (0.85% of consumption) exceeds the *sum* of the gains from the separate agreements with exclusions (0.5% of consumption). The reason again is that the combined agreements reduce the trade diversion impacts of either of the agreements separately.

FTAA plus EU-MERCOSUR (both with excluded products) and 50% MERCOSUR tariff cuts. In column (3) of Table 12 we present the results for a combination of the FTAA and a MERCOSUR agreement with the EU (with excluded products in both regional arrangements) plus a unilateral 50% tariff cut by MERCOSUR. The estimated gains to Brazil are 0.97 percent of Brazilian consumption. Comparing columns (2) and (3), the additional gains from unilateral liberalization derive from both reducing trade diversion of the preferential arrangements and improved resource allocation from moving closer to world prices of imports.

FTAA plus EU-MERCOSUR (both with excluded products) combined with 50% Multilateral Trade reform in goods. In column (4) of Table 12 we present the results of the combination of the regional agreements and a multilateral agreement. We assume that the EU-MERCOSUR agreement excluded the highly protected agricultural products, but that they are included in the multilateral agreement. This is the strategy some of the leaders in Brazil have advocated — pursue regional trade agreements while at the same time pursuing multilateral trade liberalization, since it is presumed that only multilateral negotiations will succeed in achieving agricultural tariff reduction and export subsidy reduction. Given the onset of the Doha Development Agenda, we examine the impact of a 50% multilateral tariff cut in all regions (including MERCOSUR) while MERCOSUR also participates in the FTAA and a free trade agreement with the EU (with excluded products). Analytically, this scenario is similar to the previous one except that the all countries in the world lower their tariff by 50%, not just MERCOSUR. In this scenario MERCOSUR countries obtain improved access to the markets of the rest of the world and Japan (compared the scenario of a regional arrangement with the EU and the FTAA), but the preferred access that MERCOSUR negotiates in these regional arrangements is eroded by the multilateral liberalization. Thus, there are offsetting effects from multilateral liberalization to the MERCOSUR countries, given regional arrangements in place, but on balance multilateral liberalization produces gains for MERCOSUR countries. We find that Brazil will gain 1.14 percent of its personal consumption in aggregate. Compared with the results of column (3), which includes unilateral liberalization in MERCOSUR, the gains are due to additional market access to the rest of the world and Japan, along with liberalization in the US and the EU of products excluded in the regional arrangements.

The four poorest rural households and the four poorest urban households all gain substantially more as a percent of their personal consumption. This is because, as explained in Section 3, the sectors that use unskilled labor intensively expand relative to the other sectors, driving up the wage of unskilled labor relative to the prices of other factors of production. Since the poor depend more on the wage of unskilled labor, their incomes rise several times faster than the average.

Tariff Uniformity. In column (5) of Table 12 we show estimates of the impact of MERCOSUR moving to a uniform tariff. That is, we impose a uniform tariff in MERCOSUR and allow the rate to adjust such that collected revenue from the tariff in Brazil is unchanged. We find that the uniform tariff rate is able to fall to seven percent.

The results from this scenario indicate that a movement to a uniform tariff in MERCOSUR would convey significant benefits to Brazil of 0.66% of personal consumption. In fact, the gains are larger than the gains to Brazil from a 50% unilateral across the board tariff cut. The reason tariff uniformity conveys benefits is that distortion costs of a tariff regime rise more than proportionately with the tariff. Thus, the largest gains derive from chopping off the tariff peaks.

These results are consistent with our earlier results (Harrison, Rutherford and Tarr [1993] [2002]) in which we have shown that a movement toward uniformity will convey a significant share of the benefits of moving to free trade when tariffs are diverse. In addition, Martinez de Prera [2000] evaluated the consequences of moving to uniform tariffs from the actual tariff structures in CGE models of 13 separate countries. She found that there would be welfare gains from tariff uniformity in all 13 countries. Evidently, tariffs do not typically differ from uniformity in these economies due to efficiency of taxation reasons.[31] On the contrary, the large gains from trade liberalization are typically derived from reducing tariff peaks, which is effectively accomplished with tariff uniformity. Reducing low tariffs results in proportionately smaller gains, and may even result in losses if the

[31] The set of elasticities we have chosen, however, makes uniformity beneficial in general. That is, the Ramsey optimal taxation rule suggests that higher taxes should be placed on the goods with the lower elasticity of demand. With our virtually homogeneous choice of elasticities, the Ramsey optimal tariffs are close to uniform.

importing country possesses monopsony power.[32] Thus, we find that tariff uniformity in MERCOSUR can convey significant benefits to Brazil

In addition, we see that tariff uniformity is slightly progressive as well. The four poorest households gain more when measured as a percent of their own household consumption.

FTAA plus EU-MERCOSUR (with excluded products) combined with 50% Multilateral Trade reform in goods combined with tariff uniformity in MERCOSUR. In the sixth column of Table 12 we present estimates of the impact of pursuing all avenues — regional, multilateral and unilateral (where the unilateral action in uniformity). That is, we evaluate the combined impact of a FTAA (with US exclusions), plus an agreement between the EU and MERCOSUR (with excluded agricultural products), plus an across- the-board multilateral trade liberalization (in tariffs and export subsidies), plus tariff uniformity in MERCOSUR. This scenario adds tariff uniformity to the grand strategy scenario evaluated in column (4) of Table 12.

The gains from this scenario are, as expected, the largest of the options considered. Comparing columns (4) and (6), we see that adding tariff uniformity adds about 0.21 of a percent to the overall welfare gain to the economy. The gains from adding uniformity are less than when we consider uniformity alone. Uniformity achieves benefits from chopping off the tariff peaks, and the benefits increase geometrically with the height of the tariff. Since the regional and multilateral policies reduce the tariff peaks significantly, there are less gains from uniformity. Nonetheless, this combined scenario produces the largest aggregate gains for Brazil.

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[32] MERCOSUR may have a low optimal tariff despite being small on world markets for most products. If Brazilian exports are differentiated from the products of other countries so that Brazil in aggregate faces a downward sloping demand curve for a product, even if individual Brazilian producers do not perceive a downward sloping demand curve, then there will be an optimal export tax to maximize Brazilian export profits. The height of the optimal export tax will be inversely related to the elasticity of demand faced by Brazil in its export markets, which is in turn determined by how substitutable Brazil's products are with those of other countries. In the limit, when Brazilian products are perfect substitutes in all its export markets for products from all other countries, Brazil has no ability to obtain a higher price by restricting its exports. In this case the optimal export tax is zero.

Although Brazil imposes virtually no export taxes, the Lerner symmetry theorem tells us that in general equilibrium import tariffs are equivalent to export taxes. The import tariff will tax all export sectors roughly uniformly. However, with product differentiation and many sectors, market power on exports differs across sectors and destination markets. *Hence the import tariff is not as efficient an instrument as export taxes varying by sector and destination.* Nonetheless, if export taxes are ruled out, there is a positive optimal import tariff.

In our central elasticity scenarios we have assumed that all countries have an elasticity of substitution between imports from different countries (σ_{MM}) equal to 30. We show in Harrison, Rutherford and Tarr [1997b; Appendix C] that the optimal tariff t^* is bounded below by $t^* = \{[\sigma_{MM}/(\sigma_{MM}-1)] - 1\}$. Thus, even with $\sigma_{MM} = 30$, the optimal tariff is over 3%; but in our low elasticity scenarios, with $\sigma_{MM} = 8$, the optimal tariff is over 14%. Given the existence of an average import tariff for MERCOSUR of 12 %, the optimum tariff is lower than the existing tariff in our central elasticity scenarios.

5. Systematic Sensitivity Analysis

Since elasticity estimates are subject to a margin of error, our "remedy" for this problem, which is endemic to any large-scale model of this kind, is to undertake systematic sensitivity analyses of our major results with respect to plausible bounds on these elasticities. Essentially these procedures amount to a Monte Carlo simulation exercise in which a wide range of elasticities are independently and simultaneously perturbed from their benchmark values following prescribed probability distributions. The results of simulating the impact of the FTAA 500 times were tabulated as a distribution, with equal weight being given (by construction) to each Monte Carlo run. The upshot is a probability distribution defined over the endogenous variables of interest. In our case we focus solely on the welfare impacts of the full FTAA scenario.

Based on the distribution of results, we find there is virtually no chance that Brazil will gain less than 0.3 percent of the value of its consumption from the FTAA. We find that the FTAA members will gain at least $12 billion per year with virtual certainty, and excluded countries will lose at least $6.7 billion US dollars from the FTAA with virtual certainty. The European Union will lose around $3 billion per year with virtual certainty. Global welfare will increase by more than $3 billion per year with virtual certainty. The sensitivity results confirm the conclusions drawn from the point estimates regarding who the gainers and losers are at the aggregate country level.

Our results suggest that the poorest urban and rural households will gain more than one percent of the value of their consumption with probability close to one. In general, our point estimates are robust with respect to the probability distributions we have assumed.

6. Conclusions

Our results suggest that the regional arrangements under consideration by MERCOSUR, the FTAA and an agreement with the EU, can both be expected to result in gains to Brazil. The agreement with the EU is about 1.5 times as valuable as the FTAA due to access to highly protected agricultural markets in the EU. The combined gains from both agreements will be greater than the gains obtained from the sum of the agreements separately due to a reduction of trade diversion. The big countries in these agreements, however, may exclude their most protected products from the agreements. In that case, the FTAA will be more valuable to Brazil than the agreement with the EU.

We find that tariff uniformity also yields benefits for Brazil. Unilateral application of uniform tariffs in MERCOSUR, such that collected tariff revenue in Brazil is unchanged, would yield benefits even larger than a unilateral 50% tariff cut in MERCOSUR.

Most of the trade policy options we evaluate, either regional, multilateral or unilateral, result in a distribution of the gains to the different households that is progressive, such that the poorest households experience the greatest percentage increase in their incomes. This is because the trade policy changes tend to shift resources from capital intensive manufacturing toward unskilled labor intensive agriculture, thereby inducing an increase in the wage of unskilled labor relative to the other prices of factors of production. This is turn results in a percentage increase in the incomes of the poorest households in Brazil relative to the richest. The percentage increase in the incomes of the poorest households is three to four times greater than the percentage increase in the income of the average for the economy as a whole.

Our estimates indicate that the apparent Brazilian strategy of simultaneously pursuing a MERCOSUR agreement with the EU plus the FTAA, while supporting multilateral trade liberalization at the WTO, is well considered. Brazil can optimize its choice of trade policies by combining regional arrangements in both the Americas and the EU with multilateral liberalization. If tariff uniformity is added to the regional and multilateral liberalization, still further gains would be realized.

Both the FTAA and the EU-MERCOSUR arrangements are net trade-creating for the countries involved, but excluded countries almost always lose from the agreements. Multilateral trade liberalization results in gains to the world more than four times greater than either of these relatively beneficial regional arrangements, showing the importance to the world trading community of the multilateral negotiations.

References

Athukorala, Premachandra, and Reidel, James, "Demand and Supply Factors in the Determination of NIE Exports: A Simultaneous Error-Correction Model for Hong Kong: A Comment," *Economic Journal,* 104, November 1994, 1411-1414.

Arndt, C., A. Cruz, H. T. Jensen, S. Robinson and F. Tarp, *Social Accounting Matrices for Mozambique 1994 and 1995*, TMD Discussion Paper Series No. 28, Washington D.C.: International Food Policy Research Institute, July 1998.

Bakoup, Ferdinand, and David Tarr, "The Economic Effects of Integration in the Central African Economic and Monetary Community: Some General Equilibrium Estimates for Cameroon," *African Development Review*, Vol. 12, No. 3, December 2000, 161-190.

Barros, R. P., Corseuil, C. H., and Cury, S.,."Abertura commercial e liberalização do fluxo de capitais no Brasil: impactos sobre a pobreza e desigualdade," in Henriques, R. (Org.). *Desigualdade e pobreza no Brasil.* (Rio de Janeiro: IPEA, 271-298, 2000. Translation: Trade opening and liberalization of capital flows in Brazil: impacts on poverty and inequality.

Bhagwati, Jagdish, and Panagariya, Arvind, "Preferential Trading Areas and Multilateralism: Strangers, Friends or Foes?" in J. Bhagwati and A. Panagariya (eds.) *The Economics of Preferential Trade Arrangements* (Washington D.C.: The American Enterprise Institute Press, 1996).

Bond, Eric, "Using Tariff Indices to Evaluate Preferential Trading Arrangements: An Application to Chile," *Unpublished Manuscript*, Department of Economics, Pennsylvania State University, January 24, 1996.

Bonelli, R. and Fonseca, R., *Ganhos de produtividade e de eficiencia: novos resultados para a economia brasileira.* Pesquisa e Planejamento Economico, Rio de Janeiro, v. 28, n. 2, p. 273-314, August 1998. (Translation: Productivity and efficiency gains: new results for the Brazilian economy)

Burfisher, Mary E.; Robinson, Sherman, and Thierfelder, Karen, "The Effects of an FTAA on Agricultural Trade in the Western Hemisphere," *Unpublished Manuscript*, U.S. Department of Agriculture, 2002.

Cardoso Teixera, Erly, "Impacts of AFTA and MERCOEURO on Agribusiness in the MERCOSUL Countries," mimeo, Federal University of Viscosa, Brazil. Available at: http://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=1017

Dimaranan, Betina V. and Robert A. McDougall. *Global Trade, Assistance, and Production: The GTAP 5 Data Base*, Center for Global Trade Analysis, Purdue University, 2002. Documentation available at http://www.gtap.agecon.purdue.edu/databases/v5/v5_doco.asp

Feijo, C. and Carvalho, P. G. M., *Sete teses equivocadas sobre o aumento da produtividade industrial nos anos recentes.* Boletim de Conjuntura, IEI/UFRJ, July 1994. (Translation: Seven mistaken theses about industrial productivity growth in recent years.)

Ferreira, P. C. and Rossi, J. L., *New evidence on trade liberalization and productivity growth.* Ensaios Economicos da EPGE, n. 433, 2001.

Ferreira, Francisco. H. G.; Lanjouw, Peter., and Neri, Marcelo, "The Urban Poor in Brazil in 1996: A New Poverty Profile Using PPV, PNAD and Census Data," *Unpublished Manuscript*, The World Bank, October 1999.

Ferris, M. C., and Munson, T. S., "Complementarity Problems in GAMS and the PATH Solver," *Journal of Economic Dynamics and Control*, 24(2), 2000, 165-188.

Harrison, Glenn W.; Jones, Richard; Kimbell, Larry J., and Wigle, Randall, "How Robust Is Applied General Equilibrium Analysis?" *Journal of Policy Modelling*, 15(1), 1993, 99-115.

Harrison, Glenn W.; Rutherford, Thomas F., and Tarr, David, "Piecemeal Trade Reform in the Partially Liberalized Economy of Turkey," *World Bank Economic Review*, 7, May 1993, 191-217.

Harrison, Glenn W.; Rutherford, Thomas F., and Tarr, David G., "Increased Competition and Completion of the Market in the European Community: Static and Steady-State Effects," *Journal of Economic Integration*, 11(3), September 1996, 332-365.

Harrison, Glenn W.; Rutherford, Thomas F., and Tarr, David G., "Economic Implications for Turkey of a Customs Union with the European Union," *European Economic Review*, 41(3-5), April 1997a, 861-870.

Harrison, Glenn W.; Rutherford, Thomas F., and Tarr, David G., "Quantifying the Uruguay Round," *Economic Journal*, 107(444) , September 1997b, 1405-1430.

Harrison, Glenn W.; Rutherford, Thomas F., and Tarr, David G., "Trade Policy Options for Chile: A Quantitative Evaluation," *World Bank Policy and Research Working Paper 1783*, 1997c. Available at HTTP://WWW.WORLDBANK.ORG/RESEARCH/TRADE/ARCHIVE.HTML

Harrison, Glenn W.; Rutherford, Thomas F., and Tarr, David G., "Trade Liberalization, Poverty and Efficient Equity," *Journal of Development Economics*, forthcoming, 2003. Available at HTTP://WWW1.WORLDBANK.ORG/WBIEP/TRADE/POVERTYCONF.HTML

Harrison, Glenn W.; Rutherford, Thomas F., and Tarr, David G., "Trade Policy Options for Chile: The Importance of Market Access," *The World Bank Economic Review*, 16 (1), 2002, 49-79.

Harrison, Glenn W.; Rutherford, Thomas F., and Wooton, Ian, "The Economic Impact of the European Community," *American Economic Review (Papers & Proceedings)*, 79(2), May 1989, 288-294.

Harrison, Glenn W.; Rutherford, Thomas F., and Wooton, Ian, "An Alternative Welfare Decomposition for Customs Unions," *Canadian Journal of Economics*, 26(4), November 1993, 961-968.

Harrison, Glenn W., and H.D. Vinod, "The Sensitivity Analysis of Applied General Equilibrium Models: Completely Randomized Factorial Sampling Designs", *The Review of Economics and Statistics*, 74, May 1992, 357-362.

Hatta, Tatsua, "A Theory of Piecemeal Policy Recommendations," *Review of Economic Studies*, 44(1), February 1977, 1-21.

Hausner, U., *A 1995 Social Accounting Matrix for Zambia*, TMD Discussion Paper Series No. 49, Washington D.C.: International Food Policy Research Institute, September 1999.

Melo, Jaime de, and Tarr, David, *General Equilibrium Analysis of U.S. Foreign Trade Policy* (Cambridge, MA: MIT Press, 1992).

Martinez de Prera, Josefina, "Revenue-Neutral Tariff Reform: Welfare Effects of Uniform Tariffs in 13 Developing Countries," Chapter 3 of Ph.D Dissertation, University of Colorado, 2000. Available at HTTP://USSUB.COLORADO.EDU/~MARTINDP/

Matoo, Aaditya; Fink, Carsten; Marconini, Mario; and Valls Pereira, Lia, "Brazil's Services Trade and International Trade Negotiations," (Washington DC.: The World Bank, 2002, mimeo).

Michalopoulos, Constantine, and Tarr, David, "The Economics of Customs Unions in the Commonwealth of Independent States," *Post-Soviet Geography and Economics*, 38(3), 1997, 125-143.

Moreira,M., *Etrangeiros em uma economia aberta: impactos sobre a produtividade, concentracao e comercio exterior.* BNDES, Texto par Discussao n. 67, 75p., March 1999. (Translation: Foreigners in an opened economy: impacts on productivity, concentration and trade.)

Muendler, Mark-Andreas, Trade, Technology, and Productivity: A Study of Brazilian Manufacturers: 1986-1998, University of California at Berkeley, mimeo, 2001.

Pereira, Lia Valls, "Estudo Sobre Linhas Estrutuais Da Posicao Brasileira, Nos Principais Setores produtivos, de interesse do Brasil, No Ambito Do Exercicio de Conformacao Da ALCA no Ambito Das Negociacoes Do MERCOSUL Com a Uniao Europeia," Research Report realized under a contract between Fundação Getulio Vargas and o Ministério de Desenvolvimento, Indústria e Comércio do Brasil. December 1999.

Pinheiro, A. M., and Moreira, M. M., *The profile of Brazil's manufacturing exporters in the nineties: what are the main policy issues.* BNDES, Texto para Discussao n. 80, 54p., June 2000.

Reidel, James, "The Demand for LDC Exports of Manufactures: Estimates from Hong Kong," *Economic Journal*, 98, March 1988, 138-148.

Reinert, Kenneth A., and Roland-Holst, David W., "Armington Elasticities for United States Manufacturing Sectors," *Journal of Policy Modelling*, 14(5), 1992, 631-639.

Rossi Junior, J. L., and Ferreira, P. C., *Evolucao da produtividade industrial brasileira e abertura comercial.* IPEA, Texto para discussao n. 651, 31 p. June 1999. (Translation: Evolution of Brazilian industrial productivity and trade opening)

Rutherford, Thomas F., "Applied General Equilibrium Modeling with MPSGE as a GAMS Subsystem: An Overview of the Modeling Framework and Syntax, *Computational Economics*, 14 (1/2), October 1999, 1-46

Rutherford, Thomas F.; Rutström, E.E., and Tarr, David G, "Morocco's Free Trade Agreement with the European Community," *Economic Modelling*, 14(2), April 1997, 237-269.

Rutherford, Thomas F., and Tarr, David G, "Regional Trading Arrangements for Chile: Do the Results Differ with a Dynamic Model?" *Trade and Integration*, forthcoming, 2003.

Rutherford, Thomas F., and Tarr, David G, "Trade Liberalization, product variety and growth in a small open economy: a quantitative assessment," *Journal of International Economics*, 56(2), March 2002, 247-272.

Schiff, Maurice, and Chang, Won, "Market Pressure, Contestability, and the Terms of Trade Effects of Regional Integration," *Journal of International Economics*, 60(1), 2003, 161-175.

Shiells, C.R., and Reinert, K.A., "Armington Models and Terms-of-Trade Effects: Some Econometric Evidence for North America," *Canadian Journal of Economics*, 26(2), 1993, 299-316.

Shorrocks, A.F., "Inequality Decomposition by Factor Components, " *Econometrica*, 50, 1982, 193-212.

Thomas, M. and M. Bautista, *A 1991 Social Accounting Matrix (SAM) for Zimbabwe*, TMD Discussion Paper Series No. 36, Washington D.C.: International Food Policy Research Institute, January 1999.

Winters, L. Alan, and Chang, Won, "Regional Integration and Import Prices: An Empirical Investigation," *Journal of International Economics*, 51(2), 2000, 363-77.

Wonnacott, Paul, and Wonnacott, Ronald, "Is Unilateral Tariff Reduction Preferable to a Customs Union? The Curious Case of the Missing Foreign Tariffs," *American Economic Review*, 71(4), September 1981, 704-714.

World Bank, *Rural Poverty Alleviation in Brazil: Towards an Integrated Strategy,* Washington DC: The World Bank, 2001.

World Bank, *Trade Blocs* (Oxford and New York: Oxford University Press, 2000).

World Trade Organization, *Trade Policy Review, Brazil 2000* (Geneva: WTO Publications, 2000).

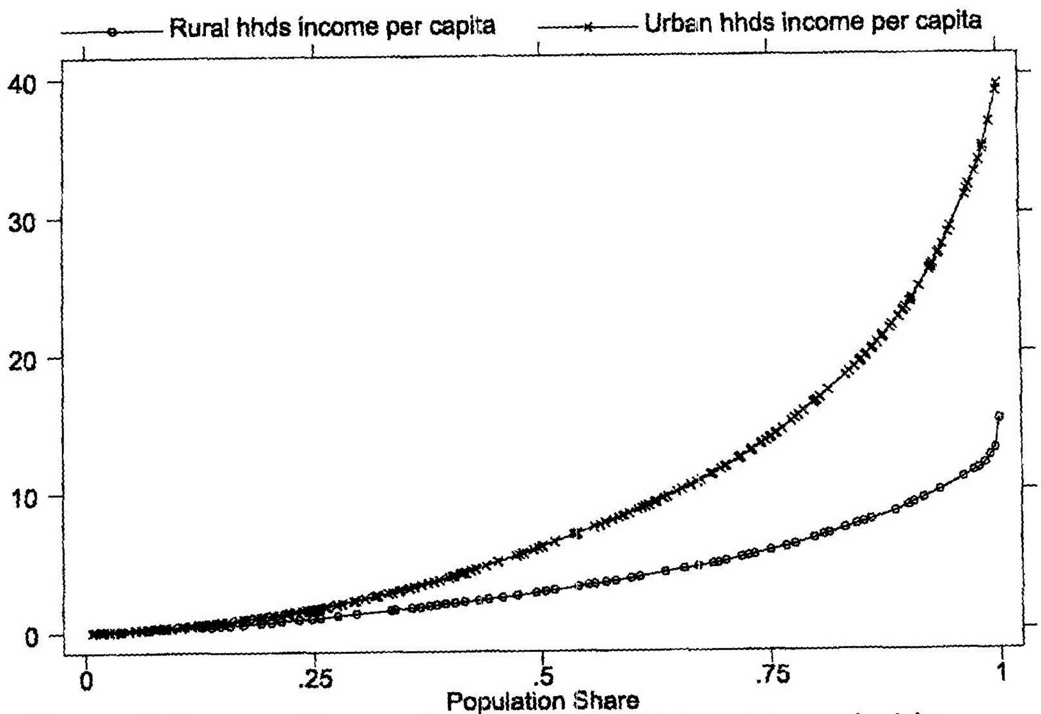


Figure 1: Lorenz Curves for Rural and Urban Households

Table 1: List of commodities, regions, households

Commodities

PDR	Paddy rice
GRO	Cereal grains
OSD	Oil seeds
AGR	other agriculture
OCR	Other crops*
CMT	Bovine meat products
OMT	Other meat products
MIL	Dairy products
PCR	Processed rice
SGR	Sugar
OFD	Other food products
ENR	Energy and mining
TEX	Textiles
WAP	Wearing apparel
LEA	Leather products
LUM	Wood products
MAN	Other manufacturing
I_S	Iron and steel
FMP	Other metal products
MVH	Motor vehicles and parts
SER	Services
CGD	Savings good
DWE	Dwellings

*Note. Our "other crops" is an aggregate of the following sectors from the full GTAP dataset: wheat, vegetables and fruits, fiber based plants, wool, forestry, fishing and the GTAP category other crops.

Regions

BRA	Brazil
ARG	Argentina
URY	Uruguay
CHL	Chile
COL	Columbia
PER	Peru
VEN	Venezuela
XAP	Rest of Andean Pact
MEX	Mexico
XCM	Central America and Caribbean
XSM	Rest of South America
CAN	Canada
USA	United States of America
E_U	European Union 15
JPN	Japan
ROW	Rest of World

Factors

CAP	Capital
LAB	Unskilled labor
LND	Land
RES	Natural resources
SKL	Skilled labor

Household Types and Characteristics

Rural	mean per capita income*	mean household income*	% of sample	number of households** (in millions)	Urban	mean per capita income	mean household income*	% of sample	number of households** (in millions)	*Monthly household income in 1996 Reals*
Rhh1	48	129	5.89	6.10	Uhh1	63	135	4.38	4.54	0 - 206
Rhh2	103	259	3.92	4.06	Uhh2	131	264	5.54	5.74	207 - 313
Rhh3	116	364	2.64	2.73	Uhh3	155	375	6.14	6.36	314 - 431
Rhh4	140	489	2.31	2.39	Uhh4	196	497	6.78	7.03	432 - 564
Rhh5	165	647	1.87	1.94	Uhh5	239	649	7.34	7.61	565 - 741
Rhh6	228	838	1.41	1.46	Uhh6	286	846	8.74	9.05	742 - 964
Rhh7	286	1074	0.7	0.73	Uhh7	390	1123	9.27	9.60	965 - 1290
Rhh8	385	1528	0.96	0.99	Uhh8	479	1561	8.06	8.35	1291 - 1889
Rhh9	615	2282	0.32	0.33	Uhh9	752	2449	8.99	9.31	1890 - 3196
Rhh10	2363	7864	1.52	1.58	Uhh10	2187	6728	13.22	13.70	3197 - 66809
Total Rural			21.54	22.31	Total Urban			78.46	81.27	

* Income figures are in 1996 Reals.
** The number of households the stratified sample is estimated to represent.
Source Authors' calculations from the Living Standards Measurement Survey conducted by IBGE.

Table 2: Structure of economic activity in Brazil

VA	Value added net of tax ($ millions)
VA%	Sectoral value added as a percent of aggregate value added
UNSK%	Unskilled labor share of value added, in percentage form
SKL%	Skilled labor share of vadlue added, in percentage form
CAP%	Capital share of value added, in percentage form
LAN%	Land share of value added, in percentage form
EXPORT	Value of exports
EXPORT%	Sector exports as a percentage of aggregate exports
Export Intensity	Sector exports as a percentage of domestic output
IMPORT	Value of imports
IMPORT%	Sector imports as a percentage of aggregate imports;
Import Intensity	Sector imports as a percentage of domestic demand

	VA	VA%	UNSK%	SKL%	CAP%	LAN%	EXPORT	EXPORT%	EXPORT INTENSITY	IMPORT	IMPORT%	IMPORT INTENSITY
PDR	763	0.1	72	8	19					110		4
GRO	2449	0.3	71	8	18	3	47		1	144		3
OSD	2780	0.4	36	4	50	10	1795	3	28	419		8
AGR	15471	2.2	67	8	21	4	2986	5	7	646	1	2
OCR	33643	4.8	81	9	7	2	3923	7	7	2832	3	5
ENR	24736	3.5	9	4	87		4441	8	6	7742	9	9
CMT	2421	0.3	23	12	65		260		2	262		2
OMT	1088	0.2	23	12	65		1488	3	20	36		1
MIL	2473	0.4	13	13	74					596	1	5
PCR	168		23	24	52					252		6
SGR	483	0.1	28	25	47		1576	3	22			
OFD	13699	1.9	17	18	65		1866	3	3	1936	2	3
TEX	4068	0.6	21	9	70		1060	2	5	1726	2	8
WAP	3545	0.5	32	14	54		205		1	710	1	4
LEA	1554	0.2	40	14	46		2300	4	31	573	1	10
LUM	4676	0.7	30	11	59		1765	3	12	383		3
MAN	60391	8.6	19	14	67		16615	29	9	41537	46	19
I_S	3359	0.5	12	4	84		4203	7	16	746	1	3
FMP	6788	1	39	17	44		725	1	3	1231	1	5
MVH	9865	1.4	15	7	79		5378	9	12	10273	11	21
SER	509359	72.4	27	24	49		7536	13	1	18046	20	2

Source: 1996 Brazilian IO table and GTAP database (version 5)

Table 3: Structure of protection for all countries in the sample*

	BRA**	USA	CAN	MEX	ARG	CHL	COL	PER	VEN	URY	XCM	XAP	XSM	EUR	JPN	ROW
PDR	12	5	***	15	12	11	13	22	13	12	25	12	15	65	409	7
GRO	7	1	9	38	7	11	12	12	12	7	9	11	5	44	20	77
OSD	6	18	***	3	6	11	11	12	11	6	5	8	4	3	76	52
AGR	10	3	12	17	10	11	17	12	17	10	12	17	7	13	18	24
OCR	8	14	2	12	9	11	12	16	12	9	9	9	7	10	46	20
ENR	4	0	1	7	5	11	9	12	6	5	6	6	4	1	-1	5
CMT	12	5	16	35	12	11	19	15	19	12	15	18	11	95	36	34
OMT	14	4	72	68	14	11	18	20	18	14	20	19	13	61	58	33
MIL	19	42	215	38	19	11	19	19	17	19	24	18	16	90	287	43
PCR	15	5	1	15	15	11	20	20	20	15	36	20	18	86	409	19
SGR	19	53	5	4	19	11	18	12	18	19	20	17	24	76	116	17
OFD	18	8	29	22	18	11	18	15	19	18	16	18	17	28	34	32
TEX	16	11	16	15	16	11	17	16	17	16	16	11	16	10	8	16
WAP	20	13	21	33	20	11	20	20	20	20	24	15	23	12	13	17
LEA	26	13	15	25	26	11	16	18	18	23	15	15	19	8	15	13
LUM	15	2	7	13	13	11	17	12	16	14	15	15	20	3	3	11
MAN	13	2	3	10	13	11	9	12	10	13	9	9	11	4	1	7
I_S	13	3	5	8	12	11	10	12	12	12	6	9	11	3	3	8
FMP	16	4	6	14	16	11	14	12	15	16	10	12	16	4	1	12
MVH	26	2	5	14	26	10	21	12	25	29	13	20	14	5		13

*Import share trade weighted average import tariff defined over the set of countries subject to positive tariffs.
**See Table 1 for definitions of countries and products.
***There are only imports are from the US and these are not subject to duties.

Table 4A: Household income shares from factors of production and transfers

Household*	Income Shares (in percentages)					
	Skilled labor	Unskilled labor	Rent from Capital	Rent from Land	Transfers	Sum
Rhhd1	5.7	68.1	2.9	1.1	22.2	100.0
Rhhd2	8.3	80.2	0.2	0.0	11.3	100.0
Rhhd3	10.8	86.7	0.2	1.7	0.7	100.0
Rhhd4	8.5	64.5	2.9	1.9	22.2	100.0
Rhhd5	10.9	56.8	32.3	0.0	0.0	100.0
Rhhd6	22.0	47.3	30.6	0.0	0.0	100.0
Rhhd7	8.8	49.2	41.7	0.3	0.0	100.0
Rhhd8	15.4	62.0	20.1	2.5	0.0	100.0
Rhhd9	18.3	45.0	35.3	1.4	0.0	100.0
Rhhd10	7.3	75.3	14.8	2.7	0.0	100.0
Uhhd1	0.6	70.4	0.2	0.4	28.4	100.0
Uhhd2	18.1	67.2	0.6	0.3	13.9	100.0
Uhhd3	9.6	73.7	2.9	0.2	13.6	100.0
Uhhd4	13.4	67.8	8.5	0.2	10.1	100.0
Uhhd5	27.2	56.5	15.6	0.0	0.6	100.0
Uhhd6	28.1	52.4	19.4	0.0	0.0	100.0
Uhhd7	27.1	30.4	42.5	0.0	0.0	100.0
Uhhd8	32.9	27.9	39.2	0.0	0.0	100.0
Uhhd9	29.8	21.0	49.2	0.0	0.0	100.0
Uhhd10	16.6	14.8	68.6	0.0	0.0	100.0

Table 4B: Household expenditure shares on commodites

Household*	Expenditure Shares (in percentages)																	
	Cereal grains	Other agriculture	Other crops	Energy & mining	Bovine meat products	Other meat products	Dairy products	Processed rice	Sugar	Other food products	Textiles	Wearing apparel	Leather products	Wood products	Other manufacturing	Other metal products	Motor vehicles & parts	Services	Dwellings
Rhhd1	0.4	4.4	10.4	2.0	6.6	3.5	5.5	2.3	1.8	25.5	1.8	4.4	1.6	1.9	14.4	0.8	4.5	8.2	0.0
Rhhd2	0.3	4.1	9.7	2.2	6.1	3.3	5.1	2.2	1.7	23.7	1.9	4.6	1.7	2.0	15.3	0.9	4.8	10.4	0.0
Rhhd3	0.3	4.0	9.6	2.2	6.1	3.3	5.0	2.2	1.7	23.5	1.9	4.7	1.7	2.0	15.4	0.9	4.8	10.7	0.0
Rhhd4	0.3	3.3	7.8	2.2	5.0	2.7	4.1	1.8	1.4	19.2	2.0	4.8	1.7	2.0	15.7	0.9	4.9	20.3	0.0
Rhhd5	0.3	3.1	7.3	2.4	4.6	2.5	3.8	1.6	1.3	17.8	2.1	5.1	1.9	2.2	16.9	0.9	5.3	21.0	0.0
Rhhd6	0.2	2.8	6.6	3.3	4.2	2.3	3.5	1.5	1.2	16.3	3.0	7.2	2.6	3.1	23.6	1.3	7.4	10.0	0.0
Rhhd7	0.2	2.2	5.1	3.4	3.3	1.7	2.7	1.2	0.9	12.6	3.0	7.2	2.6	3.1	23.9	1.3	7.5	12.8	5.4
Rhhd8	0.2	2.5	5.9	2.2	3.7	2.0	3.1	1.3	1.0	14.3	1.9	4.7	1.7	2.0	15.4	0.9	4.8	32.4	0.0
Rhhd9	0.1	0.9	2.1	0.8	1.3	0.7	1.1	0.5	0.4	5.1	0.7	1.8	0.6	0.8	5.8	0.3	1.8	75.1	0.0
Rhhd10	0.3	4.0	9.4	1.9	5.9	3.2	4.9	2.1	1.6	23.0	1.7	4.1	1.5	1.8	13.6	0.8	4.3	15.8	0.0
Uhhd1	0.4	4.3	10.1	1.9	6.4	3.5	5.3	2.3	1.8	24.9	1.6	4.0	1.4	1.7	13.1	0.7	4.1	12.5	0.0
Uhhd2	0.4	4.2	10.1	2.1	6.4	3.4	5.3	2.3	1.8	24.7	1.9	4.5	1.6	1.9	14.8	0.8	4.7	9.2	0.0
Uhhd3	0.3	3.9	9.2	1.9	5.8	3.1	4.8	2.1	1.6	22.6	1.6	4.0	1.4	1.7	13.2	0.7	4.1	13.9	4.0
Uhhd4	0.2	2.8	6.6	2.4	4.2	2.2	3.4	1.5	1.2	16.1	2.1	5.1	1.8	2.2	16.6	0.9	5.2	18.1	7.4
Uhhd5	0.2	2.9	6.8	1.9	4.3	2.3	3.6	1.5	1.2	16.6	1.7	4.1	1.5	1.7	13.4	0.8	4.2	16.3	15.2
Uhhd6	0.2	2.2	5.2	2.0	3.3	1.8	2.7	1.2	0.9	12.7	1.8	4.3	1.5	1.8	14.0	0.8	4.4	19.8	19.5
Uhhd7	0.2	1.9	4.5	2.1	2.8	1.5	2.3	1.0	0.8	10.9	1.9	4.5	1.6	1.9	14.9	0.8	4.7	24.7	16.8
Uhhd8	0.1	1.4	3.3	1.7	2.1	1.1	1.7	0.7	0.6	8.0	1.5	3.6	1.3	1.5	11.9	0.7	3.7	55.2	0.0
Uhhd9	0.1	0.7	1.6	0.7	1.0	0.5	0.8	0.4	0.3	3.9	0.6	1.5	0.5	0.6	5.0	0.3	1.6	79.9	0.0
Uhhd10	0.1	1.0	2.4	1.7	1.5	0.8	1.2	0.5	0.4	5.8	1.5	3.6	1.3	1.6	11.9	0.7	3.7	60.3	0.0

*Households are defined in Table 1.

Note: Paddy rice, oil seeds and iron and steel are zero for all households.

Source: Authors' calculations based on the LSMS survey data for Brazil, 1996.

Table 5A: The Impact of MERCOSUR Trade Policy Options on Different Countries
(welfare change as a percent of consumption-- central elasticities)

	AGREEMENTS *							
Country	FTAA (1)	FTAA (excluded products) (2)	EU - MERCOSUR (3)	EU - MERCOSUR (excluded products) (4)	FTAA and EU - MERCOSUR (5)	Unilateral 50% tariff cut (6)	Multilateral Tariff Liberalization by 50% (7)	FTAA no MERCOSUR Liberalization (8)
Brazil	0.6	0.4	0.9	0.1	1.8	0.4	0.9	0.4
Argentina	-0.2	-0.2	2.3	0.2	2.2	0.2	0.3	0.2
Uruguay	1.7	1.6	43.9	1.2	43.4	1.4	7.3	0.4
Chile	1.1	1.1	-0.2	0.0	0.9	0.1	1.3	0.8
Columbia	1.7	2.0	-0.1	-0.1	1.7	0.0	1.0	1.7
Peru	1.0	1.0	-0.1	0.0	0.9	0.0	1.3	1.0
Venezuela	1.1	1.1	0.0	-0.1	1.1	0.0	0.9	1.1
Rest of Andean Pact	1.9	2.0	0.0	0.0	1.9	0.1	2.5	1.8
Mexico	0.3	0.4	0.0	0.0	0.3	0.0	0.5	0.0
Central America and Caribbean	4.3	4.8	0.0	0.0	4.4	0.0	2.1	4.6
Rest of South America	0.8	0.8	-1.2	0.1	0.0	0.3	4.1	0.1
Canada	0.0	0.1	0.0	0.0	0.0	0.0	0.2	0.1
United States of America	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
European Union 15	-0.1	0.0	0.5	0.1	0.4	0.0	0.8	-0.1
Japan	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0
Rest of the World	-0.1	-0.1	0.0	0.0	-0.1	0.0	2.3	-0.2

* **FTAA** Free Trade Agreement of the Americas

FTAA (excluded products) Free Trade Agreement of the Americas, with US antidumping policy denying improved access to its four protected sectors

EU-MERCOSUR A Free Trade Agreement between MERCOSUR and the European Union

EU-MERCOSUR Excluded Products-- A Free Trade Agreement between MERCOSUR and the European Union , with the most seven most protected food and agricultural products in the European Union excluded from the agreement

FTAA and EU-MERCOSUR *Free Trade Agreement of the Americas combined with a free trade agreement between MERCOSUR and the European Union*

Unilateral 50% tariff cut—a MERCOSUR only tariff cut by 50%.

Multilateral tariff liberalization—All regions reduce tariffs and export subsidies by 50%.

FTAA (no MERCOSUR liberalization) Free Trade Agreement of the Americas, but MERCOSUR does not change its own external tariff to the rest of the Americas.

Table 5B: The Impact of MERCOSUR Trade Policy Options on Different Countries
(welfare change as a percent of consumption-- low elasticities)

	AGREEMENTS *							
	FTAA	FTAA (excluded products)	EU - MERCOSUR	EU - MERCOSUR (excluded products)	FTAA and EU - MERCOSUR	Unilateral 50% tariff cut	Multilateral Tariff Liberalization by 50%	FTAA no MERCOSUR Liberalization
Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Brazil	0.2	0.1	0.6	0.0	1.1	0.2	0.6	0.2
Argentina	-0.2	-0.2	1.2	0.0	1.3	0.0	0.5	-0.2
Uruguay	0.0	0.0	17.3	0.2	17.3	0.6	3.4	0.0
Chile	0.6	0.6	-0.2	-0.1	0.4	0.1	0.9	0.6
Columbia	1.0	1.2	0.0	0.0	1.0	0.0	0.7	1.0
Peru	0.5	0.5	-0.1	0.0	0.4	0.0	0.7	0.5
Venezuela	0.7	0.7	0.0	0.0	0.7	0.0	0.6	0.7
Rest of Andean Pact	1.3	1.4	0.0	0.0	1.3	0.1	1.8	1.3
Mexico	0.2	0.2	0.0	0.0	0.1	0.0	0.1	0.2
Central America and Caribbean	3.1	3.3	-0.1	0.0	3.1	0.0	1.5	3.1
Rest of South America	0.2	0.2	-0.9	0.1	-0.4	0.4	1.9	0.2
Canada	-0.1	0.0	0.0	0.0	-0.1	0.0	0.1	-0.1
United States of America	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
European Union 15	-0.1	0.0	0.2	0.1	0.1	0.0	0.4	-0.1
Japan	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0
Rest of the World	-0.1	-0.1	0.0	0.0	-0.1	0.0	1.4	-0.1

* See Table 5A for description of Agreements.

Table 6A: The Impact of MERCOSUR Trade Policy Options on Different Countries (welfare gain in billions of 1996 US dollars -- central elasticities)

	AGREEMENTS *							
	FTAA	FTAA (excluded products)	EU - MERCOSUR	EU - MERCOSUR (excluded products)	FTAA and EU - MERCOSUR	Unilateral 50% tariff cut	Multilateral Tariff Liberalization by 50%	FTAA no MERCOSUR Liberalization
Country	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Brazil	3.1	2.3	5.0	0.5	9.5	1.9	4.6	2.3
Argentina	-0.5	-0.5	5.9	0.5	5.7	0.5	2.0	0.5
Uruguay	0.2	0.2	6.5	0.2	6.4	0.2	1.2	0.1
Chile	0.5	0.6	-0.1	0.0	0.5	0.1	0.7	0.4
Columbia	1.1	1.3	-0.1	-0.1	1.1	0.0	0.6	1.1
Peru	0.4	0.4	0.0	0.0	0.4	0.0	0.6	0.4
Venezuela	0.7	0.7	0.0	0.0	0.7	0.0	0.5	0.6
Rest of Andean Pact	0.4	0.4	0.0	0.0	0.4	0.0	0.5	0 3
Mexico	0.9	1.0	0.0	0.0	0.7	0.0	1.2	0 0
Central America and Caribbean	3.4	3.8	0.0	0.0	3.5	0.0	1.7	3 6
Rest of South America	0.1	0.1	-0.1	0.0	0.0	0.0	0.3	0.0
Canada	0.1	0.3	0.0	0.0	-0.1	0.0	0.8	0.2
United States of America	2.3	2.0	-0.4	-0.4	1.7	0.3	3.0	-0.5
European Union 15	-2.6	-2.2	25.0	5.6	21.2	1.6	39.3	-3.2
Japan	-1.0	-0.9	0.7	0.4	-0.5	0.3	45.7	-1 2
Rest of the World	-4.8	-4.2	-0.2	-0.2	-5.0	1.3	83.6	-5.6
Sum for Included Countries	12.7	12.4	42.3	6.9	51.6	NA	NA	9.1
Sum for Excluded Countries	-8.4	-7.2	-0.2	-0.4	-5.5	NA	NA	-9.9
Sum over all countries	4.3	5.2	42.2	6.4	46.1	NA	186.0	-0.9

* See Table 5A for description of Agreements.

Table 6B: The Impact of MERCOSUR Trade Policy Options on Different Countries (welfare gain in billions of 1996 US dollars -- low elasticities)

	AGREEMENTS *							
Country	FTAA (1)	FTAA (excluded products) (2)	EU - MERCOSUR (3)	EU - MERCOSUR (excluded products) (4)	FTAA and EU - MERCOSUR (5)	Unilateral 50% tariff cut (6)	Multilateral Tariff Liberalization by 50% (7)	FTAA no MERCOSUR Liberalization (8)
Brazil	1.2	0.7	3.1	-0.1	5.6	1.2	3.3	1.2
Argentina	-0.4	-0.5	3.2	-0.1	3.3	0.1	1.3	-0.4
Uruguay	0.0	0.0	2.6	0.0	2.5	0.1	0.5	0.0
Chile	0.3	0.3	-0.1	0.0	0.2	0.1	0.5	0.3
Columbia	0.6	0.7	0.0	0.0	0.7	0.0	0.5	0.6
Peru	0.2	0.2	0.0	0.0	0.2	0.0	0.3	0.2
Venezuela	0.4	0.4	0.0	0.0	0.4	0.0	0.4	0.4
Rest of Andean Pact	0.2	0.3	0.0	0.0	0.3	0.0	0.3	0.2
Mexico	0.5	0.5	0.0	0.0	0.3	0.0	0.2	0.5
Central America and Caribbean	2.4	2.6	-0.1	0.0	2.4	0.0	1.2	2.4
Rest of South America	0.0	0.0	-0.1	0.0	0.0	0.0	0.1	0.0
Canada	-0.2	-0.1	0.0	0.0	-0.2	-0.1	0.4	-0.2
United States of America	3.5	3.3	-0.6	-0.6	2.6	0.4	2.7	3.5
European Union 15	-2.5	-2.3	8.7	4.2	5.3	1.2	21.3	-2.5
Japan	-0.9	-0.9	0.2	0.2	-0.8	0.3	26.3	-0.9
Rest of the World	-3.6	-3.3	-1.1	-0.7	-4.5	0.9	51.8	-3.6
Sum for Included Countries	8.8	8.5	17.5	4.1	23.6	NA	NA	8.8
Sum for Excluded Countries	-7.0	-6.5	-1.9	-1.2	-5.3	NA	NA	-7.0
Sum over all countries	1.7	2.0	15.6	2.9	18.2	NA	110.9	1.7

* See Table 5A for description of Agreements.

Table 7: Trade Policy Options Impact on Macro Variables
(percentage change - central and low elasticities)

		AGREEMENTS *							
		FTAA	FTAA (excluded products)	EU - MERCOSUR	EU - MERCOSUR (excluded products)	FTAA and EU - MERCOSUR	Unilateral 50% tariff cut	Multilateral Tariff Liberalization by 50%	FTAA no MERCOSUR Liberalization
	Elasticity	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real exchange rate	central	2.61	2.73	2.25	2.70	3.00	1.97	1.43	-0.2
	low	1.86	2.01	1.08	1.89	1.98	1.82	1.20	1.9
Change in Tariff Revenue as a % of GDP	central	0.60	0.56	0.56	0.55	0.69	0.10	0.12	0.0
	low	0.52	0.50	0.50	0.48	0.72	0.20	0.24	0.5
Unskilled labor wage rate	central	2.91	1.87	4.24	2.42	5.81	0.94	3.02	0.0
	low	1.61	1.05	2.51	1.38	3.64	0.73	2.04	0.7
Skilled labor wage rate	central	0.97	1.01	1.12	0.60	1.77	0.54	0.31	1.1
	low	0.66	0.65	0.85	0.44	1.37	0.46	0.48	1.6
Rental rate on capital	central	-0.13	0.18	-0.47	-0.39	-0.31	-0.08	-0.59	-0.1
	low	0.17	0.32	0.00	-0.04	0.22	0.10	-0.09	0.2
Rental rate on land	central	14.21	9.19	25.12	14.84	31.00	5.79	30.00	4.4
	low	6.31	3.94	13.19	7.38	16.76	3.56	16.27	6.3

* See Table 5A for description of Agreements.

Table 8A: The Impact of MERCOSUR Trade Policy Options on Brazilian Households (welfare change as a percent of consumption-- central elasticities)

Household types	AGREEMENTS * FTAA (1)	FTAA (excluded products) (2)	EU - MERCOSUR (3)	EU - MERCOSUR (excluded products) (4)	FTAA and EU - MERCOSUR (5)	Unilateral 50% tariff cut (6)	Multilateral Tariff Liberalization by 50% (7)	FTAA no MERCOSUR Liberalization (8)
Rhh1	2.5	1.7	4.0	2.1	5.5	1.5	2.9	0.8
Rhh2	2.3	1.5	3.9	1.8	5.4	1.2	2.8	1.0
Rhh3	2.5	1.5	4.5	1.9	6.2	1.1	3.5	1.3
Rhh4	2.5	1.8	3.9	2.2	5.4	1.5	3.1	0.8
Rhh5	1.3	0.8	2.3	0.7	3.5	0.6	1.8	0.8
Rhh6	1.5	1.0	2.3	0.8	3.6	0.7	1.7	0.8
Rhh7	1.3	0.9	2.0	0.7	3.2	0.6	1.6	0.7
Rhh8	3.1	2.0	4.8	2.4	6.9	1.2	4.1	1.4
Rhh9	0.9	0.4	1.7	0.6	2.6	0.4	1.8	0.7
Rhh10	3.7	2.3	6.0	2.8	8.3	1.4	4.9	1.6
Uhh1	2.5	1.8	3.8	2.1	5.2	1.5	2.7	0.7
Uhh2	2.3	1.6	3.8	1.8	5.2	1.3	2.6	0.8
Uhh3	2.2	1.4	3.6	1.7	5.0	1.2	2.6	0.9
Uhh4	2.0	1.3	3.1	1.5	4.5	1.0	2.4	0.8
Uhh5	1.3	0.7	2.4	0.8	3.5	0.7	1.8	0.8
Uhh6	1.6	1.0	2.6	1.0	3.9	0.7	1.9	0.8
Uhh7	0.4	0.3	0.9	0.0	1.6	0.3	0.7	0.4
Uhh8	0.3	0.2	0.7	-0.1	1.4	0.3	0.7	0.4
Uhh9	-0.5	-0.4	-0.3	-0.7	-0.1	0.0	0.1	0.2
Uhh10	0.0	0.2	-0.2	-0.5	0.5	0.1	0.0	0.2

* See Table 5A for description of Agreements.

Table 8B: The Impact of MERCOSUR Trade Policy Options on Brazilian Households (welfare change as a percent of consumption -- low elasticities)

Household types	AGREEMENTS *							
	FTAA (1)	FTAA (excluded products) (2)	EU - MERCOSUR (3)	EU - MERCOSUR (excluded products) (4)	FTAA and EU - MERCOSUR (5)	Unilateral 50% tariff cut (6)	Multilateral Tariff Liberalization by 50% (7)	FTAA no MERCOSUR Liberalization (8)
Rhh1	1.2	0.9	2.0	1.1	3.0	1.1	1.8	1.2
Rhh2	1.1	0.7	2.0	0.9	3.0	0.8	1.8	1.1
Rhh3	1.1	0.6	2.4	0.9	3.5	0.7	2.2	1.1
Rhh4	1.2	0.9	2.0	1.1	2.9	1.1	1.9	1.2
Rhh5	0.6	0.3	1.3	0.3	2.0	0.4	1.2	0.6
Rhh6	0.7	0.5	1.4	0.4	2.2	0.5	1.2	0.7
Rhh7	0.6	0.4	1.2	0.3	1.9	0.4	1.1	0.6
Rhh8	1.5	0.9	2.7	1.2	4.0	0.8	2.6	1.5
Rhh9	0.2	0.0	0.9	0.1	1.3	0.2	1.0	0.2
Rhh10	1.8	1.0	3.4	1.4	4.9	1.0	3.1	1.8
Uhh1	1.2	0.9	1.9	1.1	2.8	1.2	1.7	1.2
Uhh2	1.1	0.7	2.0	0.9	2.9	0.9	1.7	1.1
Uhh3	1.0	0.6	1.9	0.8	2.8	0.8	1.6	1.0
Uhh4	0.9	0.6	1.6	0.7	2.5	0.7	1.5	0.9
Uhh5	0.5	0.2	1.3	0.3	1.9	0.4	1.1	0.5
Uhh6	0.7	0.4	1.5	0.4	2.3	0.5	1.3	0.7
Uhh7	0.1	0.0	0.5	-0.1	0.9	0.2	0.5	0.1
Uhh8	0.0	-0.1	0.4	-0.2	0.7	0.1	0.4	0.0
Uhh9	-0.4	-0.4	-0.3	-0.6	-0.3	-0.2	0.0	-0.4
Uhh10	0.1	0.1	0.1	-0.2	0.5	0.1	0.2	0.1

* See Table 5A for description of Agreements.

Table 9A: The Impact of MERCOSUR Trade Policy Options on Brazilian Households (welfare gain in billions of 1996 US dollars -- central elasticities)

Household types	AGREEMENTS *							
	FTAA (1)	FTAA (excluded products) (2)	EU - MERCOSUR (3)	EU - MERCOSUR (excluded products) (4)	FTAA and EU - MERCOSUR (5)	Unilateral 50% tariff cut (6)	Multilateral Tariff Liberalization by 50% (7)	FTAA no MERCOSUR Liberalization (8)
Rhh1	0.07	0.05	0.11	0.06	0.15	0.04	0.08	0.0
Rhh2	0.09	0.06	0.15	0.07	0.21	0.05	0.11	0.0
Rhh3	0.10	0.06	0.18	0.08	0.25	0.04	0.14	0.1
Rhh4	0.10	0.07	0.16	0.09	0.22	0.06	0.12	0.0
Rhh5	0.05	0.03	0.09	0.03	0.14	0.02	0.07	0.0
Rhh6	0.07	0.05	0.10	0.04	0.17	0.03	0.08	0.0
Rhh7	0.04	0.03	0.06	0.02	0.09	0.02	0.05	0.0
Rhh8	0.09	0.06	0.14	0.07	0.21	0.04	0.12	0.0
Rhh9	0.02	0.01	0.04	0.01	0.06	0.01	0.04	0.0
Rhh10	0.97	0.61	1.59	0.75	2.21	0.37	1.30	0.4
Uhh1	0.07	0.05	0.11	0.06	0.14	0.04	0.07	0.0
Uhh2	0.14	0.10	0.23	0.11	0.33	0.08	0.16	0.1
Uhh3	0.22	0.14	0.37	0.17	0.51	0.12	0.26	0.1
Uhh4	0.28	0.19	0.45	0.22	0.65	0.15	0.34	0.1
Uhh5	0.26	0.15	0.50	0.16	0.73	0.14	0.37	0.2
Uhh6	0.38	0.24	0.62	0.24	0.93	0.17	0.47	0.2
Uhh7	0.18	0.12	0.38	0.00	0.69	0.15	0.32	0.2
Uhh8	0.16	0.09	0.33	-0.04	0.67	0.14	0.33	0.2
Uhh9	-0.39	-0.36	-0.26	-0.56	-0.06	-0.01	0.06	0.2
Uhh10	0.10	0.48	-0.49	-1.12	1.04	0.23	-0.01	0.4

* See Table 5A for description of Agreements.

Table 9B: The Impact of MERCOSUR Trade Policy Options on Brazilian Households (welfare gain in billions of 1996 US dollars -- low elasticities)

Household types	AGREEMENTS * FTAA (1)	FTAA (excluded products) (2)	EU (3)	EU - MERCOSUR (excluded products) (4)	FTAA and EU - MERCOSUR (5)	Unilateral 50% tariff cut (6)	Multilateral Tariff Liberalization by 50% (7)	FTAA no MERCOSUR Liberalization (8)
Rhh1	0.03	0.02	0.05	0.03	0.08	0.03	0.05	0.0
Rhh2	0.04	0.03	0.08	0.03	0.12	0.03	0.07	0.0
Rhh3	0.05	0.02	0.10	0.03	0.14	0.03	0.09	0.0
Rhh4	0.05	0.04	0.08	0.05	0.12	0.04	0.08	0.1
Rhh5	0.02	0.01	0.05	0.01	0.08	0.01	0.04	0.0
Rhh6	0.03	0.02	0.06	0.02	0.10	0.02	0.05	0.0
Rhh7	0.02	0.01	0.03	0.01	0.05	0.01	0.03	0.0
Rhh8	0.04	0.03	0.08	0.04	0.12	0.02	0.08	0.0
Rhh9	0.01	0.00	0.02	0.00	0.03	0.00	0.02	0.0
Rhh10	0.47	0.27	0.90	0.38	1.29	0.25	0.81	0.5
Uhh1	0.03	0.02	0.05	0.03	0.08	0.03	0.05	0.0
Uhh2	0.07	0.04	0.12	0.06	0.18	0.06	0.11	0.1
Uhh3	0.10	0.06	0.19	0.08	0.28	0.08	0.17	0.1
Uhh4	0.13	0.08	0.24	0.10	0.36	0.10	0.22	0.1
Uhh5	0.11	0.04	0.27	0.06	0.41	0.08	0.24	0.1
Uhh6	0.18	0.10	0.36	0.11	0.55	0.11	0.31	0.2
Uhh7	0.05	0.01	0.22	-0.05	0.39	0.08	0.22	0.1
Uhh8	0.02	-0.03	0.18	-0.09	0.35	0.06	0.22	0.0
Uhh9	-0.38	-0.38	-0.22	-0.47	-0.22	-0.13	-0.03	-0.4
Uhh10	0.11	0.25	0.18	-0.53	1.04	0.26	0.44	0.1

* See Table 5A for description of Agreements.

Table 10A: The Impact of MERCOSUR Trade Policy Options on Brazilian Industry (percentage change in variable -- central elasticities)

Sectors	AGREEMENTS *															
	FTAA (1)				FTAA (excluded products) (2)				EU - MERCOSUR (3)				EU-MERCOSUR (excluded products) (4)			
	output	price	exports	imports	output	price	exports	imports	output	price	exports	imports	output	price	exports	imports
PDR	4	0	0	-11	4	0	0	-16	18	0	0	-51	4	0	0	-7
GRO	11	-1	16	-2	11	-2	20	-9	63	3	142	-70	14	-2	19	-8
OSD	21	0	33	8	15	0	23	20	21	0	14	51	20	0	25	-27
AGR	6	-2	16	-20	6	-3	19	-27	30	-1	72	-2	12	-4	63	-36
OCR	9	-3	48	-2	3	-3	12	5	7	0	14	5	7	-3	27	-29
ENR	2	-3	15	-18	3	-3	17	-20	0	-2	8	-23	4	-4	18	-32
CMT	6	-2	17	-18	6	-3	19	-22	36	-4	801	-96	4	-4	18	-21
OMT	8	-4	30	0	9	-4	34	0	79	-11	288	1	5	-4	18	0
MIL	7	-2	0	-67	7	-3	0	-65	8	-1	0	-70	2	-4	0	-14
PCR	3	-3	0	-11	2	-3	0	-13	12	-1	0	-82	1	-3	0	-6
SGR	27	-7	54	0	17	-6	34	0	132	-13	255	0	15	-6	30	0
OFD	2	-3	26	28	2	-4	27	23	12	-4	129	84	3	-3	10	-12
TEX	-3	-3	5	18	-2	-4	7	14	-10	-3	-4	53	-8	-4	-1	32
WAP	-3	-3	6	52	-3	-4	8	45	-6	-2	-3	89	-5	-4	-4	67
LEA	76	-8	139	-47	82	-8	149	-50	17	-3	31	-9	33	-6	57	-27
LUM	-4	-4	6	131	-4	-4	8	121	-6	-2	2	139	-2	-4	14	84
MAN	-16	-4	-8	54	-14	-5	-5	50	-24	-4	-21	74	-16	-5	-11	50
I_S	-2	0	16	-6	0	0	19	-9	-18	0	-9	32	-9	0	5	12
FMP	-10	-4	-10	82	-9	-5	-7	73	-21	-5	-26	216	-16	-6	-20	161
MVH	-8	-6	5	16	-7	-6	7	15	-7	-2	-15	4	-5	-4	-8	4
SER	1	-2	12	-30	1	-3	14	-34	1	-1	6	-17	1	-3	16	-38
DWE	0	-2	0	0	0	-3	0	0	1	-1	0	0	0	-3	0	0

Sectors	AGREEMENTS *															
	FTAA and EU - MERCOSUR (5)				Unilateral 50% tariff cut (6)				Multilateral tariff liberalization by 50% (7)				FTAA no MERCOSUR liberalization (8)			
	output	price	exports	imports	output	price	exports	imports	output	price	exports	imports	output	price	exports	imports
PDR	18	0	0	-43	0	0	0	-1	11	0	0	-33	3	0	0	2
GRO	53	2	125	-47	7	-2	11	-8	33	2	47	-31	3	2	2	2
OSD	29	0	29	121	12	0	19	-13	64	0	99	-60	3	0	2	1
AGR	32	-1	75	5	3	-3	13	-15	16	-1	58	-42	2	2	1	2
OCR	11	0	44	25	2	-3	11	3	7	0	25	-2	6	1	6	2
ENR	-2	-3	10	-16	2	-3	13	-13	-2	-1	5	-3	-2	1	1	1
CMT	38	-4	807	-87	2	-3	13	-14	12	-1	143	-81	2	2	1	2
OMT	84	-11	300	1	4	-3	13	0	27	-4	96	1	3	1	3	4
MIL	9	-1	0	-71	-2	-3	0	29	4	-1	0	-24	5	2	0	6
PCR	12	-1	0	-73	0	-3	0	1	3	0	0	-16	1	1	0	2
SGR	150	-14	289	0	10	-5	21	0	36	-5	70	0	8	0	3	0
OFD	13	-4	136	95	-1	-3	5	27	6	-1	34	-5	3	1	3	2
TEX	-11	-4	-1	65	-8	-4	-9	33	-9	-2	-9	39	2	1	2	1
WAP	-7	-3	3	124	-4	-3	-6	55	-4	-1	-6	71	0	1	2	1
LEA	74	-7	134	-41	9	-4	19	4	-10	-2	-8	37	35	-1	5	1
LUM	-8	-3	3	218	0	-3	7	39	-3	-1	2	69	0	1	1	1
MAN	-29	-5	-22	97	-9	-4	-6	28	-15	-2	-14	47	-2	1	2	0
I_S	-16	0	1	29	-2	0	7	1	-8	0	-1	9	1	0	2	1
FMP	-23	-6	-24	230	-7	-4	-9	60	-10	-2	-12	82	-1	1	2	0
MVH	-9	-5	-1	18	-1	-3	-1	1	-1	-1	-3	1	3	1	2	1
SER	1	-1	7	-19	1	-3	13	-32	0	0	2	-7	-1	1	0	0
DWE	1	-1	0	0	0	-3	0	0	1	0	0	0	0	2	0	0

* See Table 5A for description of Agreements.

Table 10B: The Impact of MERCOSUR Trade Policy Options on Brazilian Industry
(percentage change in variable -- low elasticities)

AGREEMENTS *																
	FTAA				FTAA (excluded products)				EU - MERCOSUR				EU-MERCOSUR (excluded products)			
	output	price	exports	imports	output	price	exports	imports	output	price	exports	imports	output	price	exports	imports
Sectors	(1)				(2)				(3)				(4)			
PDR	2	0	0	-7	2	0	0	-9	11	0	0	-45	2	0	0	-3
GRO	3	-2	8	3	3	-2	10	-1	22	3	35	-32	5	-2	10	-3
OSD	8	0	15	21	6	0	12	21	10	0	3	27	10	0	13	-11
AGR	3	-2	9	-1	2	-2	10	-5	16	0	35	21	6	-3	38	-8
OCR	5	-2	30	1	1	-2	7	4	4	1	9	-2	4	-2	19	-15
ENR	0	-2	8	-4	1	-2	9	-6	-1	-1	2	-5	2	-3	10	-14
CMT	2	-2	8	-5	2	-2	10	-7	25	-3	719	-85	2	-3	10	-9
OMT	3	-2	13	0	4	-3	15	0	33	-5	128	0	3	-3	11	0
MIL	4	-1	0	-40	3	-2	0	-39	4	0	0	-45	1	-3	0	-10
PCR	1	-2	0	-8	1	-2	0	-9	5	0	0	-45	1	-2	0	-3
SGR	16	-4	36	0	7	-4	17	0	99	-10	220	0	6	-4	15	0
OFD	2	-2	20	16	1	-3	21	13	7	-2	82	31	2	-2	7	-10
TEX	-1	-3	8	13	-1	-3	9	11	-1	-1	4	22	-2	-3	5	13
WAP	0	-2	12	18	0	-3	14	15	0	-1	7	19	-1	-3	5	16
LEA	32	-5	66	-22	34	-5	70	-24	7	-2	14	0	14	-4	28	-11
LUM	-1	-3	7	51	0	-3	9	47	-2	-1	3	50	1	-3	12	32
MAN	-7	-3	1	25	-6	-4	3	23	-11	-2	-9	35	-7	-4	-2	21
I_S	1	0	15	3	2	0	17	1	-9	0	-4	30	-4	0	6	17
FMP	-4	-3	1	27	-3	-3	2	24	-9	-3	-12	88	-7	-4	-8	65
MVH	-4	-4	6	14	-3	-4	7	13	-9	[illegible]	-15	12	-7	-3	-9	10
SER	0	-2	7	-12	0	-2	8	-15	0	0	1	-1	0	-2	10	-17
DWE	0	-2	0	0	0	-2	0	0	0	0	0	0	0	-2	0	0

AGREEMENTS *																
	FTAA and EU - MERCOSUR				Unilateral 50% tariff cut				Multilateral tariff liberalization by 50%				FTAA no MERCOSUR liberalization			
	output	price	exports	imports	output	price	exports	imports	output	price	exports	imports	output	price	exports	imports
Sectors	(5)				(6)				(7)				(8)			
PDR	12	0	0	-43	0	0	0	-1	6	0	0	-20	2	0	0	-1
GRO	21	2	34	-22	3	-2	7	-3	13	2	14	-14	3	-1	-1	-1
OSD	13	0	12	67	7	0	13	-2	35	0	59	-20	8	0	0	-5
AGR	18	-1	39	28	2	-3	10	-1	10	-1	44	-10	3	-2	-1	-2
OCR	7	0	31	9	1	-3	9	2	5	0	21	-1	5	-2	3	-2
ENR	-2	-1	4	-2	1	-3	10	-6	-2	-1	4	2	0	-2	-1	-2
CMT	27	-3	732	-75	1	-3	10	-7	6	-1	111	-54	2	-2	-1	-1
OMT	36	-6	136	0	3	-3	11	0	20	-4	76	0	3	-2	0	-2
MIL	5	0	0	-51	-1	-3	0	14	2	-1	0	-10	4	-1	0	5
PCR	6	-1	0	-46	0	-3	0	0	2	0	0	-10	1	-2	0	-1
SGR	112	-12	248	0	6	-4	15	0	24	-4	55	0	16	-4	1	0
OFD	8	-3	91	46	0	-3	5	17	4	-1	29	3	2	-2	1	-4
TEX	-2	-3	9	36	-4	-4	-4	22	-5	-2	-4	28	-1	-3	-1	-4
WAP	-1	-2	15	40	-2	-3	-2	36	-2	-1	-3	47	0	-2	0	-4
LEA	33	-5	67	-15	5	-4	13	12	-4	-2	-3	32	32	-5	2	-2
LUM	-2	-2	7	91	0	-3	7	21	-1	-1	4	34	-1	-3	0	-7
MAN	-15	-4	-8	52	-5	-3	-1	15	-8	-2	-6	25	-7	-3	-1	-6
I_S	-7	0	7	33	-1	0	8	7	-4	0	2	14	1	0	0	-4
FMP	-11	-4	-8	100	-4	-4	-4	30	-5	-2	-6	41	-4	-3	-1	-6
MVH	-9	-4	-3	20	-3	-3	-2	6	-4	-1	-3	7	-4	-4	-1	-8
SER	0	-1	2	-4	0	-2	10	-18	0	0	2	-3	0	-2	0	0
DWE	0	-1	0	0	0	-3	0	0	0	0	0	0	0	-2	0	0

* See Table 5A for description of Agreements.

Table 11: Decomposition of the Impact of the Free Trade Agreement of the Americas on Brazilian Households
(percentage change in welfare -- central elasticities)

	AGREEMENTS *			
Household types	FTAA (1)	FTAA uniform consumption shares (2)	FTAA uniform income shares (3)	FTAA with I-0 factor shares (4)
Sum over all households	0.6	0.6	0.6	0.5
Rhh1	2.5	2.0	1.0	0.5
Rhh2	2.3	1.8	0.7	0.3
Rhh3	2.5	2.0	0.5	0.1
Rhh4	2.5	2.1	0.9	1.0
Rhh5	1.3	0.8	0.5	0.4
Rhh6	1.5	0.7	0.9	0.7
Rhh7	1.3	0.6	0.7	0.5
Rhh8	3.1	2.8	1.0	2.2
Rhh9	0.9	1.2	0.0	0.8
Rhh10	3.7	3.2	1.1	2.0
Uhh1	2.5	2.0	1.0	0.4
Uhh2	2.3	1.8	0.9	0.2
Uhh3	2.2	1.8	0.7	0.0
Uhh4	2.0	1.6	0.7	0.9
Uhh5	1.3	1.0	0.3	0.1
Uhh6	1.6	1.4	0.6	0.4
Uhh7	0.4	0.2	0.3	0.1
Uhh8	0.3	0.3	0.2	0.0
Uhh9	-0.5	0.0	-0.3	-0.3
Uhh10	0.0	0.1	0.9	0.9

Table 12: Optimizing MERCOSUR Trade Policy Options: Impact on Brazilian Households and Aggregate Impact (welfare change as a percent of consumption -- central elasticities)

Household types	AGREEMENTS *					
	FTAA (excluded products) + Unilateral tariff cut in MERCOSUR by 50%	FTAA + EU-MERCOSUR (excluded products)	FTAA + EU-MERCOSUR (excluded products)+ 50% unilateral tariff cut in MERCOSUR	FTAA + EU-MERCOSUR (excluded products) +Multilateral Liberalization by 50%	Tariff Uniformity in MERCOSUR	FTAA + EU-MERCOSUR (excluded products)+ Multilateral Liberalization by 50% + Tariff Uniformity in MERCOSUR
	(1)	(2)	(3)	(4)	(5)	(6)
Sum over all households	0.72	0.85	0.97	1.15	0.66	1.36
hh1	2.24	3.07	3.26	3.26	1.54	4.70
hh2	1.93	2.79	2.96	2.96	1.34	4.32
hh3	1.90	2.97	3.13	3.13	1.24	5.19
hh4	2.29	3.16	3.34	3.34	1.54	4.95
hh5	1.12	1.61	1.75	1.75	0.86	2.65
hh6	1.41	1.88	2.04	2.04	1.11	2.85
hh7	1.26	1.71	1.85	1.85	0.95	2.68
hh8	2.44	3.71	3.86	3.86	1.43	6.44
hh9	0.72	1.15	1.25	1.25	0.55	2.34
hh10	2.76	4.30	4.46	4.46	1.55	7.53
hh1	2.26	3.04	3.23	3.23	1.56	4.43
hh2	2.02	2.80	2.98	2.98	1.47	4.24
hh3	1.85	2.64	2.80	2.80	1.31	4.07
hh4	1.71	2.43	2.58	2.58	1.23	3.72
hh5	1.10	1.58	1.72	1.72	0.96	2.59
hh6	1.39	1.97	2.12	2.12	1.09	3.06
hh7	0.59	0.67	0.81	0.81	0.69	1.11
hh8	0.48	0.54	0.66	0.66	0.61	0.91
hh9	-0.21	-0.39	-0.29	-0.29	0.18	-0.32
hh10	0.47	0.29	0.41	0.41	0.47	0.29

Appendix A:
Incorporating the 1996 Brazilian Input-Output Table Into the GTAP5 Data

Introduction

This appendix documents the steps undertaken to replace the GTAP5 dataset for Brazil with data from the 1996 Brazilian Input-Output table, using the GAMS (General Algebraic Modeling System) language. The motivation behind this replacement is that the original Brazilian database in GTAP5 is from 1985, and was re-balanced to match the Brazilian GDP in 1997. The Brazilian economy has changed structurally since the 1980's, due to changes as higher trade liberalization, less government intervention in the economy, and decreases in the rate of inflation. The availability of more recent data for the Brazilian economy made it feasible to update the GTAP5 database for Brazil.

There are several steps in the process:

- The Brazilian Input-Output (IO) table from 1996 was used. These data are produced by the IBGE (Brazilian Institute of Geography and Statistics, with home page www1.ibge.gov.br). IBGE publishes the IO tables for Brazil in the form of many different sub-tables, each of which shows different facets of the national accounts. The Brazilian IO tables are directly available at the IBGE home page.
- These tables were transported from an Excel file to a GAMS data file. The 1996 Brazilian IO table was relabeled to match the GTAP5 description of goods and sectors. In some cases some aggregation was done. However, it was not possible to match all goods described in the GTAP5 aggregation. To make both source of data comparable, the GTAP5 database was also aggregated to match the aggregated IO table.
- The IO table has more goods than sectors, so the sectors were dis-aggregated to match the list of commodities, using as weights the shares of the value of production of each commodity in the total value of production by sector.
- After the information in the IO table was dis-aggregated into an equal number of sectors and commodities, the data was organized to have the same GTAP5 arrays, and then checked for consistency using standard GTAP criteria. Finally, data pertaining to taxes on production, taxes on intermediate demand, taxes on final consumption, the value of factors usage, the value of intermediate input used by sector, the value of government demand and the value of private demand, were replaced in the original GTAP5 database. This replacement step utilized the GTAPinGAMS tools documented in Rutherford and Paltsev [2000], and available on the web. These tools were originally developed to undertake replacements of this kind. The original GTAP5 trade flows and trade protection data (import tariffs and export taxes) were retained. The original GTAP data were replaced by formally minimizing the difference between the original data and the new data, keeping the GTAP5 data about trade flows and trade protection unaltered, and ensuring that the new data satisfied all GTAP balancing requirements.

This appendix details this process of updating the GTAP5 database for Brazil.

The 1996 Brazilian IO table

The Brazilian IO tables are produced by the IBGE (Brazilian Institute of Geography and Statistics) as part of the National Account information. The 1996 IO table was the most recent as of 2001, when our data analysis was undertaken. Partial national account data for 1997 and 1998 are already available, but do not include data on intermediate and final demand tax revenues by sector and commodity. Hence we chose to use the 1996 IO table, which was complete.

The Brazilian 1996 IO table is organized in numerous Excel files, each representing several distinct sub-tables. The tables we utilized are:

- Table 1 - includes the value of production (80 commodities being produced by 43 sectors); imports CIF (80 commodities and 2 columns: imports without exchange emission and import of goods and services); and supply (80 commodities and 9 columns: total supply at consumer prices, commerce margin, transport margin, import tariffs, taxes in industrial production, taxes in goods circulation, other taxes, total taxes, and total supply at producer prices);
- Table 2 - includes intermediate demand (80 commodities being used in 43 sectors); final demand (80 commodities and 8 columns: exports without exchange emission, goods and services exports, public administration consumption, families consumption, gross formation of fixed capital, stock variation, final demand and total demand); and value added components (43 sectors and 14 rows: gross value added at basic price, remunerations, wages, effective social contributions, social welfare public, social welfare private, social contribution imputed, gross operational surplus inclusive of autonomous revenue, autonomous revenue, gross operational surplus, other production taxes, other production subsidies, value of production, and labor occupied);
- Table 6 - burden of the ICMS taxes, which are taxes on commodity circulation, on domestic products (80 commodities, 43 sectors and 8 final demand columns);
- Table 7 - burden of the ICMS taxes on imported products (80 commodities, 43 sectors and 8 final demand columns);
- Table 8 - burden of IPI taxes, which are taxes on industrial production, on domestic products (80 commodities, 43 sectors and 8 final demand columns);
- Table 9 - burden of IPI taxes on imported products (80 commodities, 43 sectors and 8 final demand columns);
- Table 10 - distribution of trade margins on domestic products (80 commodities, 43 sectors and 8 final demand columns);
- Table 11 - distribution of trade margins on imported products (80 commodities, 43 sectors and 8 final demand columns);
- Table 12 - distribution of transport margins on domestic products (80 commodities, 43 sectors and 8 final demand columns); and
- Table 13 - distribution of transport margins on imported products (80 commodities, 43 sectors and 8 final demand columns).

Extracting the information from the IO table to GAMS

The first step was to get the data from the IO table in Excel files into GAMS text file. Converting the raw data to GAMS at this initial step makes all of our calculations transparent to other researchers.

We introduced one row and one column between the name of sectors/commodities/agents and the numerical data in the spreadsheet. Than we enumerate each new cell in an increasing order, so that we will have a number associated with each sector or commodity or agent in the IO table.

We then select all numerical data in the sheet, including the new row and column numerated. The names of the sectors/commodities/agents do not need to be selected. Then we create a name for the area selected, what will permit GAMS to recognize the data by this name. To create this name, we click on the tool bar "Insert" in the main menu of Excel, and then in the option "Name" and in the option "Define". A window will be opened, asking for a name for the selected area. After a name has been defined, GAMS can recognize the data from the Excel file directly.

The GAMS program to extract the data should have a definition of the sets of columns and rows that will be extracted. For example, if one wants to extract a table with data about intermediate demand, with 20 commodities in rows and 10 sectors in columns, one must first define a set for rows, ranging from 1 to 20, and a set for columns, ranging from 1 to 10. Then on must define a parameter, which is a GAMS name for a multi-dimensional matrix, which will store the data and have the same size as the cardinality of the sets defined.

Finally, the GAMS libinclude XLIMPORT tool[1] is used to get the data from the IO table. The following example shows the syntax to extract the IO data from an Excel file to GAMS.

```
* GAMS code to extract data about Intermediate demand from an IO table:
set iid /1*82/, jid/1*44/;
parameter ind(iid,jid);
$libinclude xlimport ind Io_br_96.xls id
display ind
```

The code above starts with the declaration of sets. The iid and jid sets are used respectively for the rows and columns of the table in excel with intermediate demand data. In this case, we have 82 commodities (or 81 commodities plus one row with the total) and 44 sectors (or 43 sectors plus one column with the total). After the set declaration, the parameter "ind(iid,jid)" is defined. This parameter will store the intermediate demand data as a GAMS parameter. The next line contains the libinclude function: xlimport is the command which gets the data from the Excel; "ind" is the name of the parameter which will receive the data; Io_br_96.xls is the file containing the source data, and id is the area which contains the data in the Excel file. This is the same area that we selected and gave a name to above.

We apply this procedure for each of the data sets of the 1996 Brazilian IO table that we needed.

Finally, we created a file to store the parameters extracted from the IO data. This file has the extension "dat," and is created using another libinclude function, GAMS2PRM. The following example shows this process:

```
* GAMS code to store the data from an IO table:
file kdat /Io_br_96.dat/; put kdat;
$libinclude gams2prm sup s0
$libinclude gams2prm imp m0
$libinclude gams2prm vp y0
$libinclude gams2prm fd d0
$libinclude gams2prm va v0
$libinclude gams2prm ind id0
```

---

[1] The GAMS libinclude is a set of programs that reside in the GAMS "library" directory, and which can be accessed by GAMS. These tools are often added by users, and allow GAMS to be extended significantly between major version updates. They also allow users to access programs that are not tested by GAMS, and which may perform specialized functions that are not desired by the wider GAMS community. The GAMS web site, http://www.gams.com, contains more information and downloads.

These rows create a new file, io_br_96.dat. Also, this code uses the tool GAMS2PRM to include the parameters sup, imp, vp, fd, va and ind, extracted from the IO table. These parameters will have a different name in the new dat file, respectively, s0, m0, y0, d0, v0 and id0. Thus we are renaming the arrays at the same time that we save them to disk.

Re-labeling the data

The next step is to label the data extracted from the IO table to replace the numerical labels with character labels, and re-label these to match the GTAP labels for commodities.

The first sub-task is to create the different sets involved in this re-labeling process. We create sets for the original sectors and commodities in the IO table, and sets for the columns or rows of final demand, supply, value added and the imports data sets. It is also necessary to define the set of sectors using GTAP notation, since we want the data from the IO table to match.

We defined 42 sectors and commodities from the original GTAP5 sectors and commodities, which means that our IO table needed to be reorganized to match these 42 commodities. Note that GTAP5 has 58 sectors and commodities (including the sector CGD - capital goods). The Brazilian IO table does not have enough dis-aggregated information to match the 58 original GTAP5 sectors. Thus it was necessary to create a GTAP5 aggregation of the 58 sectors to 42 sectors, so that the IO table could be re-labeled. Table 1 shows the aggregation of the 58 original GTAP sectors to the 42 sectors; later in this Appendix we shows the complete correspondence between the IO commodities and GTAP5.

After we create all of the sets that are needed, we can map the IO commodities to match the 48 sectors form GTAP5. The mapping process for commodities consists of defining a set of commodities i, called mapi, and then stating the corresponding commodity or commodities in GTAP. An example illustrates this step:

```
* GAMS code to relabel data from IO to GTAP5 format:
set    mapi(i,ios) /
            PDR.3,
            WHT.11,
            GRO.7,
            OSD.5,
            OCR.(1,4,6),
            ...
            OSG.(77,78,79),
            DWE.80 / ;
```

In this example the set mapi needs to be associated to the set of GTAP5 sectors (set i in parenthesis) and to the set of IO commodities (set ios). The number 3 corresponds to the third row of the original IO table, which describes Unprocessed Rice, which is PDR in the GTAP notation. We can see from this example that GTAP sectors OCR and OSG are each associated with 3 different commodities in the IO table.

We have fewer sectors than commodities in the Brazilian IO table. To re-balance the table we create a set with codes (three letters as in the GTAP sectors description) for each sector in the IO table. Notice that these sectors do not correspond to the GTAP sectors; later in this appendix we list the correspondence between these codes and the IO sectors. We also aggregate some sectors that are more dis-aggregated in the IO data than in GTAP. For example, the Brazilian IO table has 5 different sectors that are aggregated as CRP (Chemicals, Rubber and Plastics) in GTAP.

After declaring the sets and mapping the IO commodities into GTAP format, we declare the parameters that we want to put in GTAP format. These parameters have the same name that we used to store the data in the dat file. The numbers of parameters created to re-label the IO data should be equal to the number of parameters used to store the data. The sets associated with the new parameters will be the sets with the GTAP code, the sets created for sectors in the IO table, and the several sets corresponding to rows and columns of final demand, supply, imports and value added data sets.

Since we have already declared the parameters and sets, we can include the file where the IO data is stored. This is done using the following GAMS code:

```
$include io_br_96.dat
```

where io_br_96.dat is the file created earlier to store all the data extracted from the IO table.

Now we need to put the original IO data into the new parameters that were created, applying the the re-labeling. The following GAMS code shows an example how to do this:

```
* GAMS code to pass the data from the IO table to parameters labeled in GTAP
format:
y0_(i,j) = sum((ios,jos)$(mapi(i,ios)*mapj(j,jos)), y0(ios,jos));
m0_(i,jm) = sum(mapi(i,ios), m0(ios,jm));
s0_(i,js) = sum(mapi(i,ios), s0(ios,js));
d0_(i,jd) = sum(mapi(i,ios), d0(ios,jd));
v0_(iv,j) = sum(mapj(j,jos), v0(iv,jos));
id0_(i,j) = sum((ios,jos)$(mapi(i,ios)*mapj(j,jos)), id0(ios,jos));
```

This code shows that the original IO data on the value of production, y0, will be called y0_, and it will aggregate (sum) the commodities and sectors mapped from the sets ios (IO commodities) and jos (IO sectors) to the sets i (GTAP commodities) and j (aggregated sectors from IO). The same step is applied to the other data. The sets jm, js, jd and iv are not aggregated, because they correspond to the columns or rows in the imports, supply, final demand and value added original IO data sets, respectively. In this manner we preserve the form of the data extracted from the IO table.

Now that we have the data re-labeled and stored in new parameters, we save these parameters in a dat file, as we did before for the data extracted from the IO. We use the same GAMS notation used above to create the file Io_br_96.dat, only changing the name of the dat file.

Making adjustments in the IO data

Now that we have the original IO data re-labeled in a GTAP classification of commodities, we need to do some adjustments in the data. These adjustments can be different for different kinds of original IO tables. In the Brazilian case, we were concerned about the following characteristics of the original IO data:

- that the number of sectors was different than the number of commodities;
- values were measured in 1996 Brazilian currency; and
- the presence of a sector used to correct the value of GDP.

These characteristics require adjustments to the IO data, explained below.

A new GAMS file is created to do these adjustments. We declare the sets for commodities (i) and sectors (j), as well as the sets for rows and columns used in the other files. We declare the parameters, using the same names that they received in the last dat file created. Then we include the file that has these data, using the same notation shown before. Finally, we create the parameters that will contain the data after all adjustments necessaries.

The first adjustment deals with the sector used to correct the value of GDP. This sector was created in the IO table by IBGE to allow the measure of the services in the total intermediate demand paid as interest in financial transactions. As there is no information available on the value of interest paid by each sector, the sector Financial Dummy was created to incorporate the total of these payments. The intermediate demand section of the IO table shows this sector paying some amount to use the commodity financial services, and in the value added section the same value is discounted from the capital row. The methodology used to build the IO table uses the financial dummy as an artifice to avoid an overvaluation of GDP, when GDP is measured by the value added in the economy.

The usual procedure employed by researchers in Brazil to deal with this is to simply eliminate the financial dummy sector, splitting it's transactions among all other sectors in the IO table. The financial dummy sector needs to be eliminated because it is not an observed sector in the economy. We used the share of each sector in the use of the financial services as weights. Thus the positive values of the financial dummy sector in intermediate consumption will be added to the use of financial services of each sector, and the negative values in the value added will be added to the row for capital of each sector.

After we split the financial dummy sector among all other sectors, we need to put the values in the IO table in the same units used in GTAP5. The GTAPinGAMS program uses monetary values denominated in terms of tens of billions of U.S. dollars. We therefeore create two scalars in GAMS, one scale factor to multiply all data by 10e-7, and an exchange rate factor, to convert the data in Brazilian currency to US$ dollars. The exchange rate factor is applied to all parameters. We also create a scalar that rescales the data in the IO table to match the Brazilian value of GDP in GTAP5. We multiply all parameters by this scalar. This will convert the data from the 1996 IO table to 1997 values.

The last adjustment is to transform the number of sectors to match the same number of commodities. We do this by the procedure of diagonalization of the data. In other words, we use the share of each commodity in the value of production of the sector as a weight to split the number of sectors in the IO table to be the same number of commodities. We sum the value of production of each commodity produced by many sectors, and assume that the total value of the commodity produced by the sector that has the same name of the commodity. In other words, we assume a technology in which each sector produces only one commodity. Here is this procedure in GAMS:

```
* GAMS code to diagonalize the IO table to have equal number of commodities
and sectors
theta(i,j)$sum(ii, y0(ii,j)) = y0(i,j) / sum(ii, y0(ii,j));
id(i,ii) = rescgdp * scalefac * sum(j, id0(i,j) * theta(ii,j)) / exchrate ;
v(k,i) = rescgdp * scalefac * sum(j, v0(k,j) * theta(i,j)) / exchrate ;
y(i) = rescgdp * scalefac * sum(j, y0(i,j)) / exchrate ;
```

In this code theta is the parameter that calculates the shares of each commodity in the total value produced by a sector; y0, id0 and v0 are the re-labeled parameters for value of production, intermediate demand and value added, respectively; id, v and y are the new parameters for intermediate demand, value added and value of production, respectively, after all adjustments; rescgdp, scalefac and exchrate are the scalars used to rescale GDP and adjust for exchange rate units. The diagonalization process is done at same time that the other adjustments are done. In the new parameters (y, id and v), the set used to sectors is now the same used for commodities (i or ii).

Some data, such as the data about total supply, do not need to be diagonalized since they are organized solely by commodities. However, they still need to be adjusted by the scalar factors.

Before storing the diagonalized and adjusted parameters, we apply a check on the parameters to ensure that the different adjustment process were done correctly. This check verifies the zero profit condition and supply-demand balance. In other words, we check if the new IO data, after being re-labeled, diagonalized, tumbled, dried, and otherwise adjusted, is still consistent.

Denominating the IO data in GTAP arrays

The next step in the preparation of the Brazilian IO table to replace the original GTAP5 data is to identify the parameters in the IO table that are used in the GTAP arrays, and give the corresponding name to them. These parameters should correspond to the parameters explicitly represented in the GTAPinGAMS dataset, which are shown in Table 2. The data pertaining to trade flows, trade protection and transport services, however, cannot be changed in the original GTAP5 database.

To undertake this task we declare the sets for the GTAP sectors and commodities, and then declare the sets for rows and columns in the import, value added, supply and final demand data sets. We declare the parameters stored in the last dat file, and we include this dat file.

We then declare parameters in the form of GAMS arrays, and define each parameter to the corresponding IO parameter. First, it is necessary to be careful to the way that the data in the IO is presented (e.g., if it is net or gross of taxes) and the current definition of the parameter in GTAP array. Second, the taxes *rates* should be extracted here, since the IO data usually shows tax *revenue*, and the GTAPinGAMS programs work with tax rates. Third, the intermediate demand for the sector CGD (Capital Goods) should be defined separately, since investments are normally represented in the final demand table in the IO.

For the Brazilian IO table, the data about trade and transport margins is included in the intermediate demand and final demand data. This means that the Brazilian IO table is valued at consumer prices. Tables 10 through 13 of the IO table show how trade and transport margins are attributed to each sector. We removed the trade and transport margins from each commodity being consumed by the sectors or by the agents, and add them to the commodity TRD, which covers trade and transports services.

After defining the GTAP arrays using the values from the IO table, it is necessary to again check the consistency of the data in GTAP format. These consistency conditions are written using the notation of the GTAPinGAMS programs. One way to write the condition of supply equal demand is to use the equation for the parameter "market," defined in the GTAPinGAMS documentation. This parameter can be represented by the equation:

```
market(r,i) = vdfm(i,r) + vifm(i,r) - sum(j, vafm(i,j,r))
```

where vdfm(i,r) is the aggregate intermediate domestic and vifm(i,r) is the aggregate intermediate demand imported.

If the data balances, it is ready to replace the original GTAP5 data. However, in the case of the Brazilian IO table, some parameters, such as vdgm and vigm, are not disaggregated in the IO table. We use data on total government demand to check for consistency, since these aggregate data are available in the IO table. However, we need dis-aggregated data to replace the original data in GTAP. For this dis-aggregation we use the original GTAP5 shares.

The data from GTAP5 also need to be extracted and stored. We do this with a GAMS file that reads the original GTAP5 dataset, which has been aggregated to the same number of commodities used to relabel the IO data.

After we include the files containing the data to be compared, we create the parameters that will be used to compare both data sets. These parameters will receive the values of any original parameter common between the two data sets, using the new set created to differentiate the values from the two different data sets.

This last program can also be used to split the variables that are not dis-aggregated in the original IO table, such as the data about government consumption and private consumption which are not dis-aggregated by origin. In addition, the original IO data on primary factors are dis-aggregated into only two factors, capital and labor. We split these data in skilled and unskilled labor, land and capital. To split all these data we use the original GTAP5 shares for government and private demand, by origin, and the original GTAP5 shares for primary factors.

Replacing the Brazilian IO data in the GTAP5

Now that all data that we want to replace are ready, we create a "definition file" that will specify the way in which we replace the original GTAP5 data by the new data. This file should have the extension "def," and is placed in the "defines" subdirectory used by the GTAPinGAMS programs. The next example shows part of the definition file in GAMS notation used in the case of the Brazilian IO table:

```
*     Redefines to introduce the GTAP IO table from 1996.
*     Read the IO data for Brazil in 1996:
$include ..\iowork96\io.dat
set bra(r) /bra/;
loop(bra(r),
      ty(i,r) = bty(i,r);
      ti(j,i,r) = bti(j,i,r);
      tp(i,r) = btp(i,r);
      vafm(j,i,r) = bvafm(j,i,r);
      vfm(f,i,r) = bvfm(f,i,r);
      vpm(i,r) = vipm(i,r) + vdpm(i,r);
      vipm(i,r)$vpm(i,r) = bvpm(i,r) * vipm(i,r) / vpm(i,r);
      vdpm(i,r)$vpm(i,r) = bvpm(i,r) * vdpm(i,r) / vpm(i,r);
      vgm(i,r) = vigm(i,r) + vdgm(i,r);
      vigm(i,r)$vgm(i,r) = bvgm(i,r) * vigm(i,r) / vgm(i,r);
      vdgm(i,r)$vgm(i,r) = bvgm(i,r) * vdgm(i,r) / vgm(i,r);
);
```

This example begins with the inclusion of the data ready to be replaced, which is stored in the file io.dat in the subdirectory iowork96. A set is defined for Brazil as a subset of the set r, which identifies the regions in GTAP5. This allows the process of data replacement to be applied only for Brazil. The parameters to be modified are declared inside a loop over the set BRA(r).

In the Brazilian IO case, the parameters to be replaced are the taxes on production (ty), taxes on intermediate consumption (ti), taxes on private consumption (tp), intermediate consumption (vafm), use of primary factors (vfm), private consumption (vipm and vdpm) and government consumption (vigm, vdgm). The data from the Brazilian IO table was stored in the file io.dat with the initial "b" for each parameter.

Private and government consumption are split into domestic and imported components in the definition file, using the original GTAP5 shares for domestic and imported consumption. We also undertake yet another consistency check of the IO data in the definition file.

This define file will be used by the GTAPinGAMS programs called by impose.bat to create a new balanced data set, imposing the new parameters from the IO table on an existing GTAP data set. The syntax of the commands to run the impose programs are "impose target source," where target is the name of the new data set to be created and source is the name of the data set from which the original data is taken.

The programs called by impose.bat replace the original data set by minimizing the difference between the original data and the new data, keeping the trade flows and trade protection data unaltered. A new data set is created, different from the original and from the IO data.

The impose.bat batch file is located in the "build" subdirectory of the GTAPinGAMS programs. This batch file is executed by invoking the MS-DOS prompt from this subdirectory.. In the case of the Brazilian IO table we type "impose brazil ftaaio" at the MS-DOS prompt (without the quotation marks) and press enter. The name of the definition file is brazil and the name of the source file is ftaaio.

The impose command will generate a new data set named brazil.zip from the ftaaio.zip using the information given in the file brazil.def in the "defines" subdirectory. It also copies the set definition file ftaaio.set to brazil.set, and the mapping file ftaaio.map to brazil.map, in the "defines" subdirectory. A summary echo-print of trade and GDP shares for the new data set created is generated and placed in the "build" subdirectory.

Figure 1 shows a representation of the process used to update the data from GTAP5 with data from the 1996 Brazilian IO table. This picture shows the preparation of the data in the subdirectory Iowork96, created to do this work. The first GAMS file, get_orig_data.gms, extracts the data from the IO table in the file Io_br_96.xls, in Excel, and puts it in a dat file, Io_br_96.dat. Then the file relabel.gms change the numbers associated with commodities and sectors with characters matching GTAP notation. This information in saved in the file Io96_gtap.dat. The file diagonalize.gms does some further adjustments to the data, such as transforming the number of the sectors to match the number of commodities, transforming the data from Brazilian currency to US dollars, and rescaling GDP to match the GTAP value for 1997. This information is then stored in the file diagio.dat. The file Io_gtap.gms redefines the IO data to match the GTAP arrays, checks the consistency of the new data, and saves these data in file Io_gtap.dat. File Gtap_io.gms reads the data from files Io_gtap.dat and Gtap_io.dat, does some comparison between these data, and splits some IO data, such as factor usage, using information from GTAP5. At this point all of the information needed for the replacement of GTAP5 data by the Brazilian IO data is placed in the file Io.dat.

The data file Gtap_io.dat was created by the file Gtapio.gms, which uses the file ftaaio.zip as source for the data saved in Gtap_io.dat. The file ftaaio.zip was created by the GTAPinGAMS aggregation routine, located in the impose subdirectory. Before running the aggregation routine it is necessary to create the files ftaaio.set and ftaaio.map, and to save these files in the defines subdirectory.

The impose routine reads the files Brazil.def, ftaaio.set and ftaaio.map to generate the new dataset Brazil.zip, and copies the files ftaaio.set and ftaaio.map to new files Brazil.set and Brazil.map. The file Brazil.def includes the IO data from the file io.dat. The impose program minimizes the difference between the data assigned in the Brazil.def file and the equivalent data in the ftaaio.zip file, generating the new re-calibrated data, Brasil.zip.

Comparison of exports and imports between the 1996 Brazilian IO table and GTAP5

Table 3 shows data on exports and imports for Brazil in the GTAP5 database and in the Brazilian 1996 IO table, re-labeled to match the GTAP classification of sectors. The IO table was re-scaled to have the same GTAP5 value of GDP, as explained above. All data are in 10 US$ billions.

The total of exports is a slightly different in the two data sets. Some big differences can be identified in sectors OCR (0.39 in GTAP5 and 0.035 billions in IO96), OFD (0.187 in GTAP5, 0.625 in IO96), P_C (GTAP5 0.037 in GTAP5 and 0.17 in IO96), TRD (0.327 in GTAP5 and 0.713 in IO96), and OBS (0.286 in GTAP5 and 0.139 in IO96).

The difference between the total of imports in the two data sets is a little larger than the difference in exports. The GTAP5 data show a higher level of imports for Brazil than the IO96 data: US$ 8.982 billions compared to US$ 8.079 billions. The larger differences occur for sectors P_C (0.22 in GTAP5 and 0.658 in IO96), OME (1.816 in GTAP5 and 1.405 in IO96), ELY (0.216 in GTAP5 and 0.11 in IO96), OBS (0.394 in GTAP5 and 0.279 in IO96), and OSG (0.155 in GTAP5 and 0 in IO96).

Differences between the two data sets could arise for several reasons. The GTAP5 database uses trade statistics for 1997, and the IO table has data for 1996, re-scaled to match the GDP value of 1997. The GTAP5 data uses information from many different sources, such as the COMTRADE database from United Nations and the bilateral trade flows reported by different countries. The Brazilian IO table uses the statistics produced by the Brazilian Ministry of Industry, Commerce and Trade. Another possible source of differences in the sectoral values of trade can be a misinterpretation in the process of re-labeling the commodities and sector of the IO table to match the GTAP5 classification. The differences in the trade statistics for the sector P_C, for example, could be due to a problem in the re-labeling process, or a different classification in the raw data of the GTAP and the IO table, since the levels of exports and imports for this sector are much lower in the GTAP5 data than in the IO96 data. Some of the products from the correspondent sector P_C (petroleum and coal products) in the Brazilian IO table can be considered as products of the CRP industry (chemical, rubber and plastic products).

Input-output sectors and commodity mapping to GTAP5

Brazilian IO commodities:

```
set ios Input-output Commodities from the 1996 Brazilian IO table
/
   1       Coffee
   2       Sugar cane
   3       Rice
   4       Wheat
   5       Soybean
   6       Cotton
   7       Corn
   8       Bovine and swine
   9       Raw milk
   10      Poultry and birds (alive)
   11      Other agriculture products
   12      Iron mining
   13      Other minerals
   14      Petroleum and gas
   15      Coal and other
   16      Mineral products non metallic
   17      Metallurgical basic products
   18      Steel sheet
```

19 Primary non-ferrous metal
20 Other primary metallurgical products
21 Manufacture and maintenance of machines and equipments
22 Tractors and embank machines
23 Electric material
24 Electronic equipment
25 Automobiles - trucks and bus
26 Other vehicle and parts
27 Wood and lumber products furniture
28 Paper - cellulose - pulp and printing
29 Rubber products
30 Chemical elements non petrochemical
31 Alcohol of sugar and cereals
32 Pure gasoline
33 Fuel oils
34 Other products from refine
35 Petrochemical basic products
36 Resin
37 Gas with alcohol
38 Fertilizers
39 Ink
40 Other chemical products
41 Pharmaceutical and perfumery products
42 Plastic articles
43 Natural textile strings
44 Natural textiles
45 Artificial textile strings
46 Artificial textiles
47 Other textile products
48 Wearing apparel
49 Leather products and footwear
50 Coffee products
51 Processed rice
52 Wheat flour
53 Other processed vegetal products
54 Meat of bovines
55 Meat of poultry
56 Processed milk
57 Other dairy products
58 Sugar
59 Crude vegetal oils
60 Refined vegetal oils
61 Other food products - inclusive animal feed
62 Beverages
63 Other manufactures
64 Industrial services of public utilities
65 Construction
66 Trade margins

```
67      Transportation margins
68      Communication
69      Insurance
70      Financial services
71      Lodging and food
72      Other services
73      Private health and education
74      Services provide to companies
75      Rent of properties
76      Rent imputable
77      Public administration
78      Public health
79      Public education
80      Private services non commercials
81      External operations without exchange emission
82      Total /;
```

Mapping from the GTAP5 sectors to the commodities in the IO table (presented by numbers)

```
set  mapi(i,ios) /
   PDR.3,
   GRO.7,
   OSD.5,
   C_B.2,
   OCR.(1,4,6,11),
   CTL.8,
   OAP.10,
   RMK.9,
   OIL.(14,15),
   OMN.(12,13),
   CMT.54,
   OMT.55,
   VOL.(59,60),
   MIL.(56,57),
   PCR.51,
   SGR.58,
   OFD.(50,52,53,61,62),
   TEX.(43,44,45,46,47),
   WAP.48,
   LEA.49,
   LUM.27,
   PPP.28,
   P_C.(32,33,34,35,36,37),
   CRP.(29,30,31,38,39,40,41,42),
   NMM.16,
   I_S.(17,18),
   NFM.19,
   FMP.20,
   MVH.(25,26),
   ELE.24,
   OME.(21,22,23,63),
   ELY.64,
   CNS.65,
   TRD.(66,71,67),
   CMN.68,
        OFI.70,
        ISR.69,
   OBS.(73,74,75,76),
   ROS.72,
        OSG.(77,78,79),
        DWE.80 /;
```

Brazilian IO sectors:

```
set   jos   Sectors in the IO table /
   1  Agriculture
   2  Mineral extraction
   3  Petroleum and gas extraction
   4  Non-metallic minerals
   5  Metallurgy
   6  Non-ferrous metallurgy
   7  Other metallurgy
   8  Machines and tractors
   9  Electric material
   10 Electronic equipment
   11 Automobiles - trucks and buses
   12 Other vehicles and parts
   13 Wood and furniture
   14 Paper and publishing
   15 Rubber industry
   16 Chemical elements
   17 Petroleum refine
   18 Several chemicals
   19 Pharmaceutical and perfumery
   20 Plastic goods
   21 Textile industry
   22 Clothing apparel
   23 Footwear
   24 Coffee industry
   25 Vegetable products processing
   26 Animal slaughter
   27 Dairy industry
   28 Sugar industry
   29 Vegetable oil fabrication
   30 Other food products
   31 Several industries
   32 Industrial services of public utility
   33 Construction
   34 Commerce
   35 Transports
   36 Communication
   37 Financial institutions
   38 Services provided to families
   39 Services provided to firms
   40 Rent of properties
   41 Public administration
   42 Private services non-commercials
   43 Financial dummy
   Total of activity /;
```

Code created to identify and aggregate the IO sectors:

```
set   j      Sectors /
   AGR       Agriculture
   COG       Coal - petroleum and gas extraction
   MIN       Mineral extraction
   ANS       Animal slaughter
   VOF       Vegetal oil fabrication
   DAI       Dairy industry
   OFO       Other food products (coffee industry - beverages - tobacco)
   SUG       Sugar industry
   TXT       Textile industry
   CLA       Clothing apparel industry
```

```
FOO       Footwear
WOF       Wood and furniture
PAP       Paper and publishing
PTR       Petroleum refine
CRP       Chemicals - rubber and plastic
NMT       Non-metallic minerals
MET       Metallurgy (iron and steel)
NFE       Non-ferrous metallurgy
OME       Other metallurgy
AUT       Automobiles - trucks and buses
OVP       Other vehicles and parts
ETE       Electronic equipment
MEQ       Other machine & equipment (machines-tractors-electric material)
SVI       Several industries
ISP       Industrial services of public utility
CST       Construction
COM       Commerce
TRA       Transports
CMM       Communication
FII       Financial institutions
OSE       Other services
PAD       Public administration
PSN       Private services non-commercials
FDM       Financial dummy - will be split among the other sectors/;
```

Mapping from the codes to the Brazilian IO sectors:

```
set  mapj(j,jos) /
   AGR.1,
   COG.3,
   MIN.2,
   ANS.26,
   VOF.29,
   DAI.27,
   OFO.(24,25,30),
   SUG.28,
   TXT.21,
   CLA.22,
   FOO.23,
   WOF.13,
   PAP.14,
   PTR.17,
   CRP.(15,16,18,19,20),
   NMT.4,
   MET.5,
   NFE.6,
   OME.7,
   AUT.11,
   OVP.12,
   ETE.10,
   MEQ.(8,9),
   SVI.31,
   ISP.32,
   CST.33,
   COM.34,
   TRA.35,
   COM.36,
   FII.37,
   OSE.(38,39,40),
   PAD.41,
   PSN.42,
   FDM.43 /;
```

Appendix B: Tariff Rates in Brazil

This appendix explains how and why we correct the GTAP database of protection for Brazil. We show that our corrected version of the GTAP database of Brazilian protection closely . represents the common external tariff for MERCOSUR, where the latter is aggregated to the 57 GTAP sectors.

The two corrections we make to the GTAP database of protection for Brazil are to impose zero tariffs and subsidies on services sectors and to impose MERCOSUR (i.e., zero tariffs) on intra-MERCOSUR trade. We show that the implied collected tariff with our corrected GTAP database of Brazilian tariffs is close to, but slightly larger than, the actual collected tariff of Brazil. The remaining difference between our implied collected tariff and the actual tariff reflects preferential arrangements not incorporated in the GTAP database, and exemptions to the tariff such as duty drawback.

Average aggregate collected tariff rate

We begin by calculating the average collected tariff rate in aggregate. This will give us a point of comparison for the disaggregated data. That is, we will be able to assess whether the micro data, when aggregated, is consistent with the reported macro aggregates.

Data on tariff revenue domes from two sources and are available in Brazilian Reals (R$). The monthly values from the two sources (the Ministry of Finance and the Central Bank) and are listed in columns 1 and 3 of Table 1. We convert these data to US dollars in columns 2 and 4 of Table 1.

In Table 2 we calculate the aggregate average collected tariff rate in Brazil based on our two calculations for the tariff revenue from Table 1. Our data source for the value of imports provides the data in US dollars.

To complement these data, we note that the Federal Revenue Agency of the Ministry of Finance, reported that the average effective tariff in December of 1999 was 7.99%. This is close to the values we calculated in Table 2.

Value of average collected tariff rate and total collected tariffs in GTAP5

In Table 3 we list the sectors in the GTAP5 database along with the value of imports and tariff revenue in millions of US dollars. We then calculate the gross tariff rate by sector and present this in the third column.

Based on the data in Table 3, the average aggregate collected tariff rate in GTAP is 12.15%. This value is obtained dividing the total of the tariff revenue by the total of imports where the latter includes transport costs and the tariff. This tariff rate, however, was calculated under the assumption that it applies on MERCOSUR imports as well; thus, an adjustment is required.

Impact of correcting the collected tariffs in GTAP considering MERCOSUR

The GTAP database does not incorporate the MERCOSUR agreement. In other words, the tariff rates between the countries that form MERCOSUR are not zero in the GTAP database. In general, the MERCOSUR agreement applies zero tariffs between the members and a common external tariff (CET). This implies that the collected tariffs and tariff revenue in GTAP overestimate real collected tariffs.

We calculated the total collected tariffs in GTAP5, after subtracting the value of tariffs collected on imports from Argentina and Uruguay, as $US 8.326 billion. This compares to $US

10.962 billion with tariffs on imports from Uruguay and Argentina. After correcting for zero tariffs on MERCOSUR imports, the implied collected tariff rate in GTAP5 for Brazil is 9.23%. The difference between the 9.23% (after correcting for services and MERCOSUR) and the actual 8% collected rate most likely reflects some preferential trading arrangements not incorporated in the GTAP dataset and exemptions to the tariff such as duty drawback.

The Common External Tariff of MERCOSUR compared to GTAP tariffs for Brazil

An alternate choice for the tariff data is the legal MERCOSUR rates. It would be useful to know the relationship of the GTAP tariff to the legal tariff rates of MERCOSUR. However, MERCOSUR has about ten thousand tariff lines. It is a nontrivial and time consuming task to aggregate these ten thousand tariff lines into the into the 57 GTAP sectors. However, we performed this mapping so that we could know the correspondence between the structure of tariffs applied in GTAP and the CET of MERCOSUR.

The sources of information to undertake this aggregation were the tables available in the Central Bank and the Ministry of Development, Industry and Commerce listing the nominal rate of the CET in MERCOSUR. These tables are divided into "sections and chapters" of similar products. For example, there is a section of vegetable products, divided into chapters of living plants, fruits, cereals, etc. Some tables have the average, median and modal values of the CET for each chapter. Since one chapter can has many different value of tariffs for different products, alternative procedures were used to estimate the CET for each product aggregated in the GTAP format. The results are in Table 4.

We observe that the tariff rates in GTAP are relatively close to the estimated CET aggregated to the GTAP sectors. The simple average of the tariffs is very close.

Conclusion

These results show that the GTAP tariff levels closely reflect the MFN rates of the common external tariff of MERCOSUR. Moreover, once we correct the GTAP database by imposing zero tariffs on imports from Argentina and Uruguay, the implied collected tariff in the GTAP database is close to, but somewhat larger than, the actual collected tariff in Brazil. Remaining differences in the collected rates reflect preferential arrangements not incorporated in the GTAP database and exemptions to the tariff such as duty drawback. We conclude that the GTAP database, as corrected, is a reasonable protection database to employ to analyze Brazilian trade policy.

Appendix C: Calculation of Brazilian Factor Share Data

Data on factor shares in Brazilian industries are crucial in explaining the link between trade reform and poverty. It is well known, however, that the data on capital's share in national input-output tables in the agriculture and services sectors are notoriously unreliable. Thus, one purpose of this appendix is to present the data we have calculated on labor and capital shares in Brazilian industries and explain how we derived them.

In addition, the Brazilian input-output table does not present data on the decomposition of labor's share into skilled and unskilled labor payments. We also explain the procedure we employed to dis-aggregate the total labor payments into to skilled and unskilled labor in the Brazilian sectors.

Labor and capital shares in agriculture

The convention of the national statistical authorities who produce the IO tables in most countries is to calculate capital's share in a sector as a residual: the difference between the value of output and the payments to intermediates, taxes and labor. Sectors like services and agriculture contain a large share of self employed, temporary and informal workers. Since tax payments to the government for these workers are under-reported, the official statistics also under report labor payments. As a consequence of this, payments to agriculture labor in the 1995 Brazilian IO table (Instituto Brasileiro de Geografia e Estatística - IBGE, [2001d]) are about 13% of the payments to capital and labor. This suggests, contrary to conventional wisdom, that the agriculture sector in Brazil is capital intensive.

We held the total value added in each of the Brazilian agricultural sectors unchanged, based on the IO table. The Brazilian IO table has the value added only for the aggregate of the agricultural sectors. Thus, it was necessary to decompose aggregate capital payments into capital payments to each agricultural sector and to obtain the value of payments to labor for each agricultural sector. The payments to labor for the agricultural sectors were calculated based on data from the 1995/96 Brazilian Census of Agriculture (IBGE [2001c]). The total number of people employed in agricultural sectors (including temporary labor, owners and family members) was multiplied by 2 times the minimum wage in Brazil for 1995 to obtain the total payment to the agricultural labor and the payment to labor for each agricultural sector in the GTAP model. Table 2 lists the results for each sector. The value of total payments to the agricultural labor was subtracted from total value added in agricultural sector, obtained from the 1995 Brazilian IO table, to obtain the aggregate value of capital payments in agriculture.

In order to obtain capital payments by sub-sector within agriculture, we used the number of tractors used in each agricultural sector (data available in the 1995/96 Brazilian Census of Agriculture) as a proxy for total capital use by agricultural sector. We multiplied the total value of capital payments, obtained as described above, by the share of tractors used in each agricultural sector, to obtain capital payments in each agricultural sector. Note, however, that the sum of capital and labor payments obtained at this stage will not be in general equal value added in the sector from the IO table. Thus, we used the estimated labor and capital payments by sector as the basis for calculating the share of labor and capital payments in each sector, but we held value added from the IO table fixed.

The Brazilian Census of Agriculture does contain information about the wool (WOL) sector. For wool, we used the shares for the aggregate agriculture sector as the shares for the wool sector. The choice of 2 times the minimum wage as the average wage payment to unskilled agricultural workers was based on our estimate that the industrial sectors are paying unskilled labor about 3.33

times the minimum wage (based on the data from the 1995 IO table and the 1996 Brazilian Survey of Industry contained in IBGE [1998]). The above procedure produced a labor share of 80.6% of value added. This share is consistent with the labor shares obtained by IFPRI researchers mentioned above.

Labor and capital shares in services sectors

The 1998/99 Brazilian Survey of Services (IBGE [2001e]) has data about labor payments and value added for some service sectors: trade (TRD), ground transportation (OTP), water transportation (WTP), air transportation (ATP), communication (CMN), financial activities (OFI), insurance (ISR), business activities (OBS), recreational and other services (ROS). For these sectors, we calculated labor's share as labor payments divided by value added, and capital's share as one minus labor's share.

The construction sector (CNS) does not appear in the survey of services. However, there is a separate Annual Brazilian Survey of the Construction Industry for 1995 (IBGE [2001b]), which we used to obtain data about average payments to labor. This average payment was multiplied by the number of people employed in this sector, shown in the 1995 Brazilian IO table, to obtain the payments to labor in this sector. We calculated labor's share as labor payments divided by value added, from the IO table, and capital's share as one minus labor's share.

The Brazilian survey of services does not have information about the following GTAP5 service sectors: electricity (ELY), gas manufacture and distribution (GDT), water treatment and distribution (WTR), government services (OSG) and dwellings (DWE). The first three sectors are related to government activities in Brazil. Assuming that the government is informed about labor payments in these sectors, we keep the original capital and labor shares in the 1995 IO table. The OSG sector shows a labor share of 100% in the IO table, and the DWE sector does not exist in the IO table. Since it is not possible to produce output without some capital, we imposed a minimum capital share in these sectors. The minimum share came from the trade sector, which has the lowest capital share among the service sectors.

The capital and labor shares were considered the same for the service sectors ground transportation (OTP), water transportation (WTP) and air transportation (ATP), because of lack of dis-aggregated information. The same assumption was applied to the sectors financial activities (OFI) and insurance (ISR), and electricity (ELY), gas manufacture and distribution (GDT) and water treatment and distribution (WTR).

Labor and capital shares in industrial sectors

We kept the labor and capital shares in industrial sectors as they appear in the 1995 IO table. However, the industrial GTAP sectors PCR (processed rice) and B_T (beverages and tobacco) are not dis-aggregated in the Brazilian IO table. We used data from the 1995 Annual Brazilian Survey of Mining and Manufacturing Industries (IBGE [2001a]) to calculate it. This 1995 survey of industry has data about total payments to labor and total assets, for both sectors. We assumed 9% as a rate of return on capital to calculate capital payments from total assets. The labor and capital shares were calculated dividing the payments to each factor by the total payments to both factors.

Splitting the labor payments to skilled and unskilled labor

Manufacturing

Brazilian statistics about payments to skilled and unskilled labor are scarce. We used data from the1996 Brazilian Survey of Industries (IBGE [1998]) to calculate it. The survey of industries has the total number of people employed and the total payments, by industry. It also has the number of people and payments divided in three different categories: salaried people linked to production, salaried people not linked to production, and non-salaried people. These three categories are defined in the survey as:

- Salaried people linked to production: people directly remunerated by the firm, occupied in the activities of production of industrial goods and services, maintenance and repair of industrial equipment, and direct support to the production.
- Salaried people not linked to production: people directly remunerated by the firm, occupied in the activities of indirect support to the production, as administrative activities, security, cleaning, accounting, managerial control, merchandise, non-industrial services, transportation, construction, agricultural, etc.
- Non-salaried people: owner or partner with activities in the firm, including family members without remuneration.

The number of people normally linked to production is much higher than the number of people in the other two categories. The number of non-salaried people is small in all industrial sectors. We considered the salaried people linked to the production as unskilled workers, and the salaried people not linked to production plus non-salaried people as skilled workers. We then calculated the share of payments to unskilled labors and skilled labors in each industrial sector, dividing the payments to each category by the total payments to labor in each sector.

The GTAP sectors COL (mineral coal), OIL (crude petroleum extraction) and GAS (crude gas extraction) have equal unskilled and skilled shares, because of a lack of dis-aggregated information in the survey of industry. The same happens for the sectors CMT (bovine, sheep and horse meat) and OMT (meat of other animals).

Services and Agriculture

We were unable to find data about different labor categories in agriculture and service sectors for the Brazilian economy. To decompose labor payments in these sectors we used two proxies for the data. For relative wages, we used the ratio of unskilled to skilled wages in the industrial sectors of Brazil. For the ratio of skilled to unskilled workers we used data from comparable economies in these sectors.

The ratio of unskilled to skilled wages in the industrial sectors was obtained from the 1996 Brazilian survey of industry. The average wage of each labor category was obtained dividing the total payments to each category by the total number of people employed in that category. Taking a weighted average for all industry in Brazil, the ratio of the wage of unskilled to skilled wages was 0.57.

The ratio of unskilled to skilled workers in each sector in other countries comes from the 2000 OECD Employment Outlook. Table 1 shows the kind of information available. The service sectors are divided by OECD into 4 sub-groups: producer services (business & professional, financial, insurance, real estate); distributive services (retail trade, wholesale trade, transportation, communication); personal services (hotels & restaurants, recreational & amusement, domestic and other services); social services (government proper, health, education, miscellaneous); and construction. The GTAP sectors may be classified in the following way: producer services: business activities (OBS), financial activities (OFI), insurance (ISR); distributive services: trade (TRD), ground transportation (OTP), water transportation (WTP), air transportation (ATP), communication (CMN); personal services: recreational and other activities (ROS), dwellings (DWE); social services: government services (OSG); and construction: construction (CNS). For the sectors electricity

(ELY), gas manufacture and distribution (GDT), water treatment and distribution (WTR), which do not easily map into any of the OECD classified sectors, we choose to take the average for all of services considered in the OECD data.

We used data for Portugal as a proxy for Brazil, because it seems closest to the Brazilian economy in these sectors. The shares of skilled and unskilled workers in the agriculture and service sectors for Brazil were calculated using the ratio of unskilled to skilled workers in Portugal.

Based on the above logic, we have the following two variables as data:

R = ratio of unskilled to skilled wages (known from the industry data)

LR = ratio of unskilled to skilled workers employed (known from OECD)

We seek the share that goes to unskilled and skilled labor. By definition, unskilled labor's share is $W_U \times L_U / [W_U \times L_U + W_S \times L_S]$, where W is wages, L is labor and the subscripts U and S refer to unskilled and skilled labor respectively. Multiplying both numerator and denominator of the preceding expression by 1, in the form of $[1/ W_S \times L_S] / [1/ W_S \times L_S]$, we end up with

$$W_U \times L_U / [W_U \times L_U + W_S \times L_S] = R \times LR / [R \times LR + 1].$$

The variables on the right are data, which allow the calculation of the share of unskilled labor since 1 minus this value is skilled labor's share.

This procedure was used to each service sector, using the classification of services sectors explained above. For agricultural sectors, the shares of payments to skilled and unskilled labor were calculated for the aggregate agricultural sector, and then considered the same for all GTAP agricultural sectors, since the OECD does not show dis-aggregated data for agricultural sectors. Table 2 shows the shares of capital, unskilled and skilled labor obtained after all these procedures.

Appendix D: Survey Data on Brazilian Households

The primary source of information on each of the households in the model is a survey undertaken in Brazil in 1996 and 1997 by the Instituto Brasileiro de Geografia e Estatística (IBGE). The survey is called Pesquisa Sobre Padrões de Vida, and is often referred to by the resulting acronym PPD. We will refer to it as the LSMS survey, in reference to it being one of the Living Standards and Measurement Survey series. The geographic coverage included the Northeast and the Southeast of Brazil, spanned 19,409 individuals in 4,940 households, and covers 73% of the Brazilian population. Information was collected on consumption, income, health, education, labor force participation, and wages & salaries.

For our purposes the most attractive feature of the LSMS is that it simultaneously included information on the consumption and income of each household. There are several surveys that provide one or the other, but none that we are aware of for Brazil in recent times that collects both. This connection is particularly important for our purposes, since we stress the fact that household welfare depends on both changes in real income and changes in the purchasing power of that income. Indeed, this is arguably the only reason that one moves from a partial equilibrium analysis of household consumption data to a full-blown CGE model.[2]

There are three main stages in our analysis of the LSMS data: extracting data on income sources, extracting data on expenditure patterns, and re-balancing the household data with the remainder of the model. The "bottom line" from our analysis of the LSMS data is Table 4 in the main report; we document the steps taken to arrive at those values.

1. Income Sources

The LSMS data allow us to identify the share of income received from various sources. We assign the observed income to factors in three stages:

- Adjustments to apparent profits to correct for measurement error, and the direct assignment of sources of income other than wages and apparent profits. This stage utilizes information in the LSMS questionnaire directly.
- An *a priori* assignment of remaining "apparent profits" to the factors labor, capital and land, stressing the general belief that the poorest households in a developing country such as Brazil have very little access to capital and land ownership (in the sense that they generate monetary returns).
- An adjustment of this *a priori* mapping based on some information we have on selected households as to their detailed occupation. This information is used selectively, but we believe justifiably, to identify households whose "apparent profits" are likely due completely to their labor or not at all to land.

All detailed steps in our calculation are documented in the *Stata* program BRAZIL LSMS ANALYSIS.DO. It uses data collated in the *Stata* program BRAZIL LSMS DATA.DO. We report interim calculations from these *Stata* programs below, to facilitate readers identifying the precise steps underlying each calculation.

The following LSMS variables were mapped into wages income:

[2] An additional feature of the LSMS is that it contains information at the level of the individual. Hence it is possible for us to extend our analysis to look at the effects of individuals within households, even if that is beyond the scope of the present study.

V06B51	Last gross wage received
V06B54	Extra revenue was received with the last salary
V08A02	Revenue from retirement or pension from public welfare institute (last month)
V08A04	Revenue from retirement or pension from private welfare institute (last month)
V08A06	Revenue from bonus of permanence in the job (last month)
V08A13	Revenue from compensation or worker debts (last month)
V08A19	Revenue from unemployment insurance (last month)

Some of these items are includes as wages income even though they represent deferred compensation. All items were adjusted to be on the same annual basis.

Capital income was initially set equal to the LSMS variable V08A11, Revenue from dividends, sale of stock, revenue from saving account (last month).

Income from land was set equal to the LSMS variable V08A17, Revenue from rent or sale of property (last month).

Apparent profits were kept separate from the other factor incomes, since we needed to allocate them separately to each factor as explained later. Apparent profits were defined from the LSMS variables:

V06B22	Did you receive some net revenue in your company, firm, business (last month)?
V06B23	Value of the net revenue (last month)
V06B24	Did you receive some net revenue in your company, firm, business (last year)?
V06B25	Value of the net revenue (last year)

Some care was taken to examine the monthly and annual reports closely, since there are strengths and weaknesses of using each (the monthly report likely suffers less from recall problems, but the annual report likely better represents the general level of profits rather than some extreme month). When both monthly and annual profits were reported by the same individual, an average of the annualized amount was used.

Finally, other non-factor income was defined from the following LSMS variables:

V08A08	Revenue from life insurance (last month)?
V08A010	Revenue from alimony (last month)?
V08A15	Revenue from heritage, gambling or lottery prizes, (last month)?
V08A21	Revenue from donations, gifts, sent by people outside the house
V08A23	Revenue from other sources

Aggregating these categories of income for each household, we obtain distribution of average income sources from the LSMS shown in Table D1.

The next stage is to assign the share in Table D1 listed as apparent profits to factors of production. On *a priori* grounds we make the initial attribution shown in Table D2, based on the income decile of the household. This is an *initial* attribution since we add additional information on the occupations of (the primary income earner in) each household later. We remain open to replacing these *a priori* values with empirically based data if the right survey can be found.

We also utilize information on the detailed occupation of the primary wage earner of the household to further refine the apportionment of apparent profits. Using the assignment in Table D2 as a base, we adjusted individual households based on their major occupation. For certain occupations, listed as self-employed agricultural workers, we expect that all of the apparent profits would be a return to labor, and assign none to capital or land. For certain occupations, such as unskilled workers in manufacturing and domestic service, we expect that all of the apparent profit would be a return to labor and capital, and none to land; in these cases we therefore assign the share for land to capital, and leave the share for labor the same. The end result of these adjustments is that the percent apportionment to factors changes to the shares shown in Table D3. The main adjustments between Tables D2 and D3 are for the poorest rural households, effectively increasing the share apportioned to labor. Applying the apportionment in Table D3 to the original shares results in Table D1, the decomposition of the factor income of household types is shown in Table D4.

Table D5 reports the break-down of payments to labor into skilled and unskilled shares. This breakdown uses information in the LSMS on the detailed occupational category of the primary income earlier in each household. These data are also defined in terms of skill categories, following the standard Brazilian occupational categories. More refined breakdowns than "skilled" and "unskilled" are available in the LSMS data. Table 4 in the main report joins the information in Tables D4 and D5, by multiplying the skilled and unskilled labor shares in Table D5 by the share attributed to aggregate labor in Table D4.

2. Expenditure Shares

The LSMS provides information on the expenditures of each household, broken down by a wide range of goods and services. For example, within food consumption the data differentiate between expenditures for beef and pork. Within services, the data differentiates between weddings and alimony (referring to future services and past services, respectively). The survey data differentiate 68 separate expenditure categories, including 28 within food. This provides an opportunity to map the distribution of expenditure shares to the rest of the CGE model at a relatively fine level, allowing a richer specification of how the cost of living might vary across households as relative prices change.

At an aggregate level, the data also reveal an important diversity in expenditure patterns as one differentiates the households by income and region (rural/urban). This point is potentially important for the way in which the distributional effects of trade policies are captured in CGE models. These points may not be new to poverty analysts, but have not been accounted for in most CGE analyses of trade policy.

To see the general issue, we focus on four broad expenditure categories: housing, food, consumer goods, and services. This represents a heavy aggregation of the available data, but allows us to see the main point. The first figure shows the distribution of expenditure shares in each of these categories across the 4,932 households. These are *not* estimated shares from some statistical model that has a sampling distribution; each panel simply represents the distribution of 4,932 shares derived from the expenditure reports of each household. In each panel we also show lines indicating the median and mean expenditure share (in the top left panel these lines overlap).

Two points emerge from these charts. First, the range of expenditure shares is wide in the case of housing and food, suggesting that there is considerable diversity of expenditure patterns in these two categories across households. Second, the distributions for all categories except housing are highly skewed, such that there is a potentially important difference between estimates of central tendency based on the mean and the median. These differences are not dramatic at the level of the single, representative household, but become significant as we differentiate households.

To explore the possible sources of this diversity we partition the household according to two characteristics: whether the household is located in an urban or rural region of Brazil, and which income decile it is in. The expenditure shares employed in the CGE model, reported in Table 4 of the report, reflect this diversity.

3. Ensuring Consistency

Before including multiple households in the database for the model, we must dis-aggregate our estimates of aggregate factor endowments and expenditures in Brazil for each household. For example, based on the GTAP database and our additions, we have estimates of the value of aggregate unskilled labor in Brazil. We need to apportion this number across the households of the model. This must be done for all sources of incomes (factors of production, as well as transfers). A constraint on this allocation is that each household must receive the share of income that we estimate for it from the LSMS. Similar allocations of aggregate expenditures for each good must be undertaken.

To build a bridge from the LSMS data to the GTAP-augmented database, we employed a formal "least squares" minimization problem. The objective of the minimization problem was the deviation of the shares of income sources and expenditure patterns from the values extracted above from the LSMS. That is, we sought to find the new shares that would balance the data set but that would be as close as possible to the originally extracted shares. The computer implementation of this problem is contained in the *GAMS* program LSMS.GMS.

Table D6 shows the income shares that are generated after this adjustment process. Although these are relatively close to the shares generated from the LSMS and our adjustments, as described above, there are some significant differences for the four richest rural households. Two of them are represented as have virtually all of their income from Capital. We therefore imposed weights on the objective function of the least squares minimization problem so as to require that the re-balancing algorithm put greater weight on getting the Capital income shares for these four households right, in the sense of being closer to those specified from the LSMS data. The resulting solution is shown in Table D7, which is much closer to the shares from the data. We use the values in Table D7 in our model.

Table D1: Initial Assignment of Household Income

variable name	description
ISfacW	Share of income from labor
ISfacK	Share of income from capital
ISfacL	Share of income from land
ISfacP	Share of income from apparent profits
ISnonfac	Share of income from sources other than factors

HHDtype	ISfacW	ISfacK	ISfacL	ISfacP	ISnonfac
Rural hhd 1	0.560	0.015	0.014	0.189	0.222
Rural hhd 2	0.760	0.002	0.000	0.125	0.113
Rural hhd 3	0.821	0.001	0.032	0.139	0.007
Rural hhd 4	0.631	0.000	0.041	0.107	0.222
Rural hhd 5	0.363	0.000	0.000	0.585	0.052
Rural hhd 6	0.660	0.000	0.000	0.317	0.023
Rural hhd 7	0.603	0.000	0.000	0.397	0.000
Rural hhd 8	0.567	0.000	0.000	0.358	0.075
Rural hhd 9	0.491	0.000	0.000	0.509	0.000
Rural hhd 10	0.763	0.000	0.000	0.237	0.000
Urban hhd 1	0.643	0.000	0.003	0.070	0.284
Urban hhd 2	0.803	0.001	0.001	0.057	0.139
Urban hhd 3	0.771	0.001	0.001	0.090	0.136
Urban hhd 4	0.658	0.001	0.065	0.175	0.101
Urban hhd 5	0.713	0.002	0.010	0.154	0.122
Urban hhd 6	0.785	0.000	0.021	0.131	0.063
Urban hhd 7	0.747	0.012	0.026	0.196	0.018
Urban hhd 8	0.742	0.002	0.027	0.182	0.047
Urban hhd 9	0.741	0.003	0.005	0.210	0.041
Urban hhd 10	0.665	0.010	0.041	0.234	0.050
Total	0.713	0.004	0.020	0.166	0.097

Table D2: Initial Attribution of Apparent Profits to Factors

variable name	description
Pr2W	Percent of Apparent Profit Attributed to Labor
Pr2K	Percent of Apparent Profit Attributed to Property
Pr2L	Percent of Apparent Profit Attributed to Land

HHDtype	Pr2W	Pr2K	Pr2L
Rural hhd 1	95.0	2.5	2.5
Rural hhd 2	90.0	5.0	5.0
Rural hhd 3	80.0	10.0	10.0
Rural hhd 4	70.0	15.0	15.0
Rural hhd 5	60.0	20.0	20.0
Rural hhd 6	50.0	25.0	25.0
Rural hhd 7	40.0	30.0	30.0
Rural hhd 8	30.0	35.0	35.0
Rural hhd 9	20.0	40.0	40.0
Rural hhd 10	10.0	45.0	45.0
Urban hhd 1	95.0	2.5	2.5
Urban hhd 2	90.0	5.0	5.0
Urban hhd 3	80.0	10.0	10.0
Urban hhd 4	70.0	15.0	15.0
Urban hhd 5	60.0	20.0	20.0
Urban hhd 6	50.0	25.0	25.0
Urban hhd 7	40.0	30.0	30.0
Urban hhd 8	30.0	35.0	35.0
Urban hhd 9	20.0	40.0	40.0
Urban hhd 10	10.0	45.0	45.0
Total	52.0	24.0	24.0

Table D3: Final Attribution of Apparent Profits to Factors

HHDtype	Pr2W	Pr2K	Pr2L
Rural hhd 1	98.32	1.03	0.65
Rural hhd 2	95.63	2.65	1.71
Rural hhd 3	90.55	5.89	3.56
Rural hhd 4	79.14	13.01	7.85
Rural hhd 5	72.43	17.67	9.90
Rural hhd 6	70.35	18.60	11.05
Rural hhd 7	50.00	31.43	18.57
Rural hhd 8	39.80	35.70	24.50
Rural hhd 9	28.89	38.52	32.59
Rural hhd 10	29.21	40.96	29.83

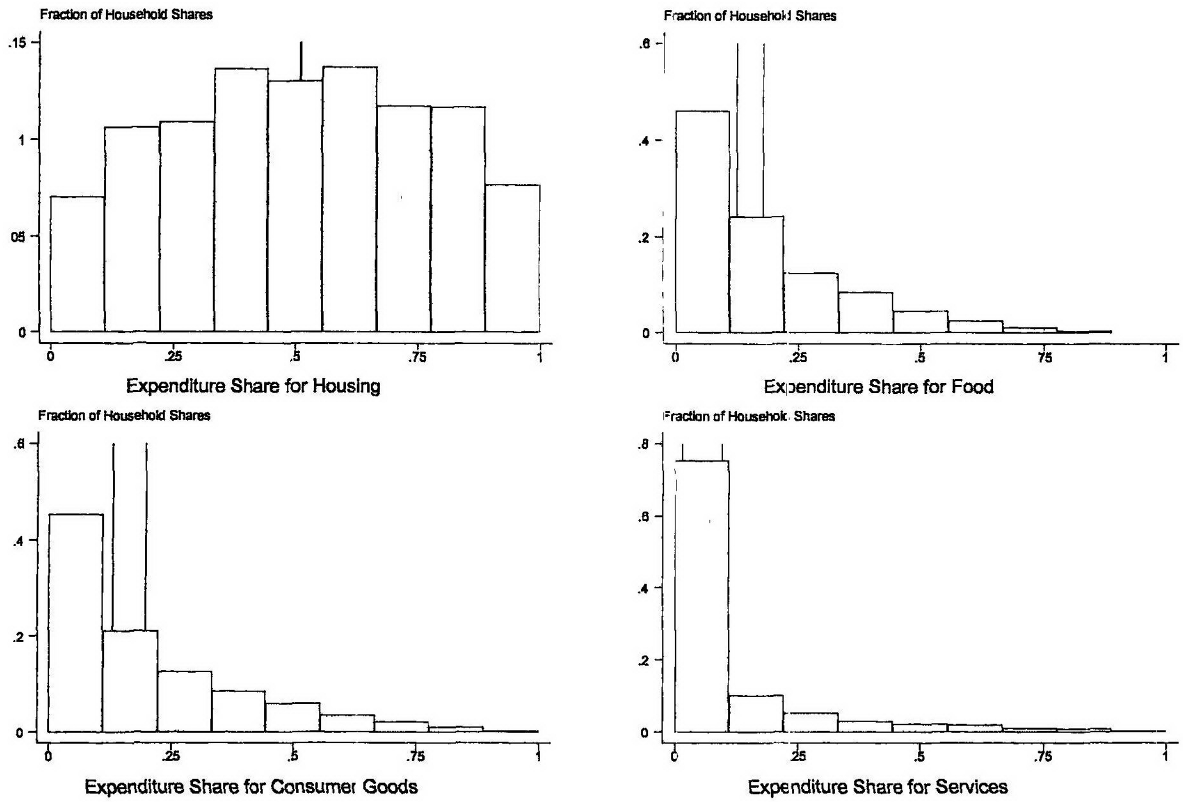
HHDtype	Pr2W	Pr2K	Pr2L
Urban hhd 1	95.26	3.09	1.65
Urban hhd 2	90.59	6.42	2.99
Urban hhd 3	80.86	13.19	5.95
Urban hhd 4	70.53	19.96	9.51
Urban hhd 5	60.66	26.15	13.19
Urban hhd 6	50.66	32.94	16.40
Urban hhd 7	40.42	37.06	22.52
Urban hhd 8	30.34	42.22	27.45
Urban hhd 9	20.00	45.36	34.64
Urban hhd 10	10.83	51.73	37.44
Total	54.58	27.71	17.71

Table D4: Final Assignment of Factor Incomes by Household Type

HHDtype	ISfacW3	ISfacK3	ISfacL3	ISnonfac
Rhhd1	0.745	0.018	0.015	0.222
Rhhd2	0.886	0.002	0.000	0.113
Rhhd3	0.958	0.002	0.033	0.007
Rhhd4	0.712	0.018	0.047	0.222
Rhhd5	0.832	0.079	0.037	0.052
Rhhd6	0.839	0.079	0.059	0.023
Rhhd7	0.762	0.230	0.009	0.000
Rhhd8	0.674	0.125	0.125	0.075
Rhhd9	0.592	0.204	0.204	0.000
Rhhd10	0.787	0.107	0.107	0.000
Uhhd1	0.709	0.002	0.004	0.284
Uhhd2	0.854	0.005	0.003	0.139
Uhhd3	0.844	0.018	0.002	0.136
Uhhd4	0.788	0.037	0.073	0.101
Uhhd5	0.808	0.048	0.022	0.122
Uhhd6	0.851	0.058	0.028	0.063
Uhhd7	0.826	0.096	0.060	0.018
Uhhd8	0.797	0.089	0.067	0.047
Uhhd9	0.783	0.102	0.073	0.041
Uhhd10	0.688	0.122	0.139	0.050
Total	0.795	0.058	0.050	0.097

Table D5: Breakdown into Labor Categories

HHDtype	wageS	wageU
Rhhd1	0.073	0.927
Rhhd2	0.088	0.912
Rhhd3	0.103	0.897
Rhhd4	0.111	0.889
Rhhd5	0.119	0.881
HHDtype	wageS	wageU
Rhhd6	0.242	0.758
Rhhd7	0.113	0.887
Rhhd8	0.186	0.814
Rhhd9	0.267	0.733
Rhhd10	0.087	0.913
Uhhd1	0.009	0.991
Uhhd2	0.187	0.813
Uhhd3	0.106	0.894
Uhhd4	0.153	0.847
Uhhd5	0.263	0.737
Uhhd6	0.278	0.722
Uhhd7	0.350	0.650
Uhhd8	0.451	0.549
Uhhd9	0.564	0.436
Uhhd10	0.523	0.477
Total	0.318	0.682



Distribution of Broad Expenditure Shares in Brazil

Table D6: Implied Income Shares After Initial Re-Balancing

Percentage allocated to each income source

Household	LND	RES	SKL	UNL	CAP	TRN	SUM
R1	1.5		5.6	67.8	2.8	22.2	100.0
R2	1.6		8.1	78.8	0.2	11.3	100.0
R3	3.6		10.4	85.1	0.2	0.7	100.0
R4	4.6		8.3	62.1	2.8	22.2	100.0
R5		0.1	10.6	58.8	30.5		100.0
R6		0.1	21.1	49.8	28.9		100.0
R7		0.3			99.7		100.0
R8		0.2	11.5	17.2	71.0		100.0
R9		0.3			99.7		100.0
R10		0.2	6.8	46.0	47.0		100.0
U1	0.4		0.6	70.3	0.2	28.4	100.0
U2	0.3		17.4	67.9	0.6	13.9	100.0
U3	0.2		9.4	74.0	2.8	13.6	100.0
U4	4.9		12.8	64.0	8.1	10.1	100.0
U5	0.9		25.8	57.8	14.9	0.6	100.0
U6	0.2	0.1	26.7	54.6	18.4		100.0
U7		0.1	26.0	33.8	40.1		100.0
U8		0.1	31.9	31.0	37.0		100.0
U9		0.2	29.9	23.6	46.4		100.0
U10		0.2	17.5	17.7	64.6		100.0

Legend: LND is Land, RES is Natural resources, SKL is Skilled Labor, UNL is Unskilled Labor, CAP is Capital, TRN is Transfers, and SUM is a control total for the row.

Table D7: Implied Income Shares After Final Re-Balancing

Percentage allocated to each income source

Household	LND	RES	SKL	UNL	CAP	TRN	SUM
R1	1.1		5.7	68.1	2.9	22.2	100.0
R2			8.3	80.2	0.2	11.3	100.0
R3	1.7		10.8	86.7	0.2	0.7	100.0
R4	1.9		8.5	64.5	2.9	22.2	100.0
R5		0.1	10.9	56.8	32.2		100.0
R6		0.1	22.0	47.3	30.5		100.0
R7	0.3	0.6	8.8	49.2	41.0		100.0
R8	2.5	0.2	15.4	62.0	19.8		100.0
R9	1.4	0.5	18.3	45.0	34.7		100.0
R10	2.7	0.2	7.3	75.3	14.6		100.0
U1	0.4		0.6	70.4	0.2	28.4	100.0
U2	0.3		18.1	67.2	0.6	13.9	100.0
U3	0.2		9.6	73.7	2.9	13.6	100.0
U4	0.2		13.4	67.8	8.4	10.1	100.0
U5			27.2	56.5	15.6	0.6	100.0
U6		0.1	28.1	52.4	19.4		100.0
U7		0.1	27.1	30.4	42.4		100.0
U8		0.1	32.9	27.9	39.0		100.0
U9		0.2	29.8	21.0	49.1		100.0
U10		0.2	16.6	14.8	68.4		100.0

Legend: LND is Land, RES is Natural resources, SKL is Skilled Labor, UNL is Unskilled Labor, CAP is Capital, TRN is Transfers, and SUM is a control total for the row.

Appendix E: Running the Brazil Model

An important attraction of numerical simulation models is that they can be replicated and extended by others. To facilitate this, we provide details on how to run our model. We intend to provide further documentation on the following web page:

HTTP://DMSWEB.BADM.SC.EDU/GLENN/BRAZIL/DISTRIBUTION/Brazil.htm

This web documentation will also provide access to further revisions of the model and applications. The team members may be contacted at DTARR@WORLDBANK.ORG, HARRISON@MOORE.SC.EDU, RUTHERFORD@COLORADO.EDU or ANGELO_GURGEL@YAHOO.COM.BR.

To run the Brazil model you will need to have the latest version of GAMS, version 20.2. This can be installed by obtaining the file SETUP.EXE from your Friendly GAMS Distributor. After that is done, just execute it. You will be taken through a standard Windows installation. If you accept the default location, your GAMS system directory will then be

C:\PROGRAM FILES\GAMS20.2

You will also be asked at the end of the installation process if you want to copy your existing license file, GAMSLICE.TXT, to this directory. Do so.

You will need to have a license that allows you to run the following solvers: CONOPT, MPSGE, and PATH.

In order to use our batch files, you will have to put GAMS on the path in order to run it from the DOS command line. The GAMS installation instructions in file WIN-INSTALL.PDF provide instructions on how to do this.

In order to use the programs which make libinclude calls you will also need to install some additional tools. To do this download the following programs into your GAMS system directory:

HTTP://DEBREU.COLORADO.EDU/INCLIB/UNZ540XN.EXE
HTTP://DEBREU.COLORADO.EDU/INCLIB/ZIP22XN.ZIP
HTTP://DEBREU.COLORADO.EDU/INCLIB/INCLIB.PCK
HTTP://DEBREU.COLORADO.EDU/XLLINK/XLLINK.EXE
HTTP://DEBREU.COLORADO.EDU/GNUPLOT/GP371W32.PCK

Then just execute UNZ540XN.EXE from Explorer, and run GAMSINST.EXE from Explorer.

At this stage you can change to the directory you have the Brazilian model code in and execute REPLICATE.BAT for a heart-pounding replication. The batch file MAKE.BAT has some leisurely pauses in the execution, so that you know where you are up to, but is computationally identical. The results are in directory .\MODEL.

The core model file is in directory .\MODEL in a file that is imaginatively called MODEL.GMS. This is the file that we would expect most trade policy modelers to want to review and modify as appropriate. The various batch files in this directory can be modified easily to execute one simulation at a time. Be sure to delete all *.SOL files, in the .\MODEL\OUTPUT directory, for the simulations you are doing, otherwise you will just have the old SOL files.

For convenience, all of the files you need (other than SETUP.EXE) will be in directory

HTTP://DMSWEB.BADM.SC.EDU/GLENN/BRAZIL/DISTRIBUTION/

Appendix F: Systematic Sensivity Analysis

To calibrate our model estimates of elasticities must be assembled for primary factor substitution, import demand, import source, and domestic demand, amongst the more important for our purposes. In the base model all elasticity values are assigned *a priori* to values which we believe are plausible central tendency estimates. Since elasticity estimates are subject to a margin of error, our "remedy" for this problem, which is endemic to any large-scale model of this kind, is to undertake systematic sensitivity analyses of our major results with respect to plausible bounds on these elasticities. Even if we are unable to specify a *point estimate* with any precision, our priors over the likely *bounds* that these elasticities could take are quite strong. To the extent that our major conclusions are robust to perturbations over these bounds, we do not see our uncertainty over specific values of these elasticities as a weakness of the model.[3]

Our sensitivity analysis employs the procedures developed by Harrison and Vinod [1992]. Essentially these procedures amount to a Monte Carlo simulation exercise in which a wide range of elasticities are independently and simultaneously perturbed from their benchmark values. These perturbations follow prescribed distributions, such as a *t* distribution with a specified standard deviation and degrees of freedom, or a uniform distribution over a specified range. For each Monte Carlo run we solve the counter-factual policy with the selected set of elasticities. This process is repeated until we arrive at the desired sample size, in our case 500. The results are then tabulated as a distribution, with equal weight being given (by construction) to each Monte Carlo run. The upshot is a probability distribution defined over the endogenous variables of interest. In our case we focus solely on the welfare impacts of the full FTAA scenario.

The sensitivity analysis we undertake reflects a diffuse set of priors over the plausible elasticity values. Specifically, it assumes that elasticities are drawn from a probability distribution, typically uniform, over a specified interval. For the elasticity of substitution between primary factors in each sector we assume a univariate normal distribution[4] in each sector using the point estimate of 1 as the mean and a standard deviations of 0.33 (the base model assumes the point estimates); for the elasticity of substitution between intermediate inputs and the value added composite in each sector we assume a uniform distribution between 0 and 0.5 (the base model assumes 0); for the elasticity of substitution between domestic products and imported products we assume a uniform distribution between 10 and 20 (the base model assumes 15); for the elasticity of substitution between imported products by source we assume a uniform distribution between 20 and 40 (the base model assumes 30); for the elasticity of transformation between domestic and export markets we assume a uniform distribution between 3 and 7 (the base model assumes 5); and for the elasticities of substitution between products in government demand and consumption demand for each household we assume an interval between 0.5 and 1.5 (the base model assumes 1). If we find that these wide ranges result in fragile inferences about welfare effects, then the next step would be

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[3] These remarks should not be interpreted as denying the value of any new empirical work on generating such elasticities. On the contrary, any effort that could generate better bounds on these point estimates is useful in generating policy conclusions that carry greater credibility, even if those conclusions will still be probabilistic in nature. Moreover, we do not consider sensitivity analysis with respect to more general functional forms, even though we share concerns with the restrictiveness of some of the popular forms we employ.

[4] Truncated from below at 0 if need be.

to employ data-based priors about plausible ranges.[5]

The results are reported in Figures 2, 3 and 4. The main welfare results for the base model are relatively robust to the range of elasticity perturbations considered here. It is worth noting that our sensitivity analysis is "local" in the sense that we perturb trade elasticities around what we believe are plausible values. Since we already know that the effects of the FTAA are sensitive to the use of significantly lower "sort run" trade elasticities, there is little point including that in our formal sensitivity analysis. In other words, it is more informative to present results conditional on short run *or* long run assumptions, and then undertake local sensitivity analysis around the precise numbers used to operationalize either of those assumptions.

In Figure 2 we show the distribution of the results of our sensitivity analysis for Brazilian welfare as a whole, measured here as a percent of consumption. One critical point is whether we have the sign right when we predict welfare gains for Brazil, and these results confirm that we do. There is virtually no chance that Brazil will gain less than 0.3 percent of the value of its consumption from the FTAA. It is slightly ironic, but nonetheless true, that one often needs to undertake extensive numerical simulation with very precise numbers just in order to determine the sign of a welfare change.

In Figure 3 we display the global distribution of welfare impacts from the FTAA, focussing on the aggregate welfare gains to the world (top left panel), the countries included in the FTAA (top right panel), the countries excluded from the FTAA (bottom left panel), and the EU (bottom right panel). In this case we report welfare in terms of billions of 1996 U.S. dollars, and employ the same horizontal scale to facilitate visual comparison of the gains and losses. The results confirm the point estimates reported in Table 6A. We see that FTAA members will gain at least $12 billion per year with virtual certainty, and excluded countries will lose at least $6.7 billion US dollars from the FTAA with virtual certainty. The European Union will lose around $3 billion per year with virtual certainty. Global welfare will increase by more than $3 billion per year with virtual certainty. The sensitivity results confirm the conclusions drawn from the point estimates regarding who the gainers and losers are at the aggregate country level.

In Figure 4 we display the impacts on the poorest households in Brazil, to confirm our conclusion that the FTAA would be beneficial for them. Welfare is measured here as percent of consumption for that household type. We also display as a vertical line the "point estimate" obtained from the simulations with the benchmark elasticities reported in Table 8a. Our results suggest that the poorest urban and rural households will gain more than one percent of the value of their consumption with probability close to one. The main inference from Figure 4 is that the welfare gains we report based on the point estimates appear to be robust to the sensitivity analysis undertaken.

In Figures 5 and 6 we undertake similar comparisons of the detailed welfare impacts for each rural and urban household. The only direct elasticity for these households that was varied was the elasticity of substitution in demand (between 0.5 and 1.5, using a uniform distribution). However, all other elasticities were varied.

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[5] This data-based method was employed, for example, in Harrison, Rutherford and Tarr [1993]. Harrison, Jones, Wigle and Kimbell [1994] advocated it as a means of minimizing the chance of overly fragile results from such sensitivity analyses. (See main text for citations.)

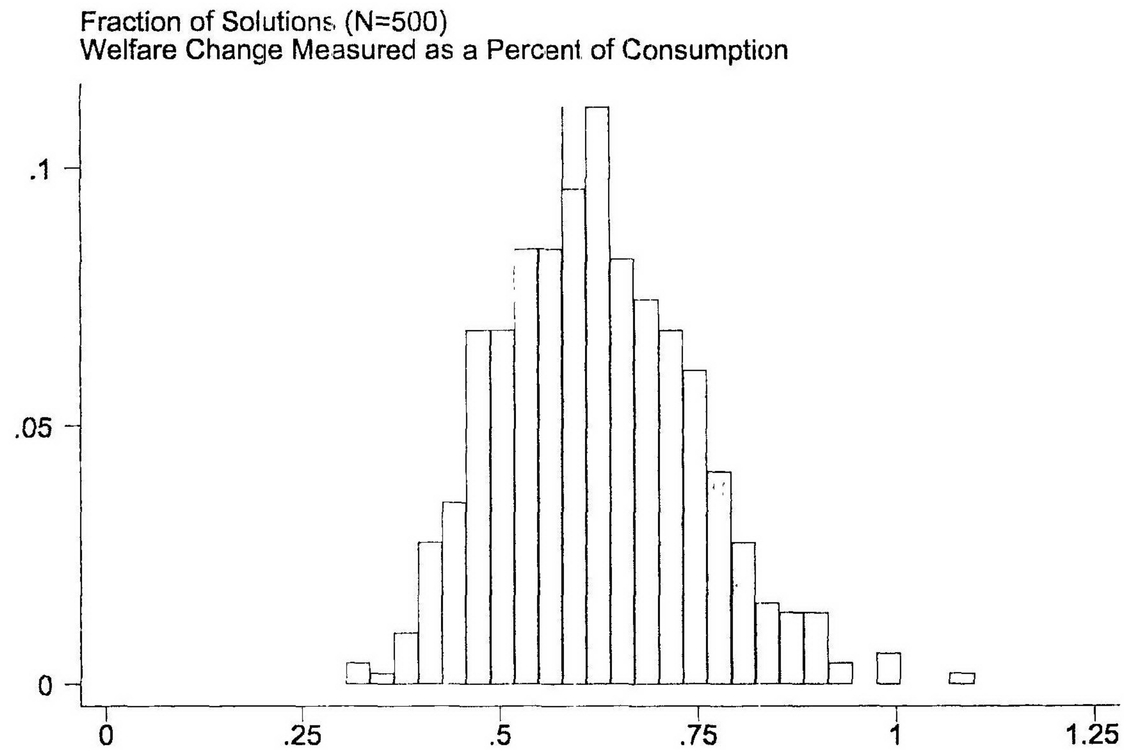

Figure 2: Sensitivity Analysis of Welfare Change for Brazil from FTAA

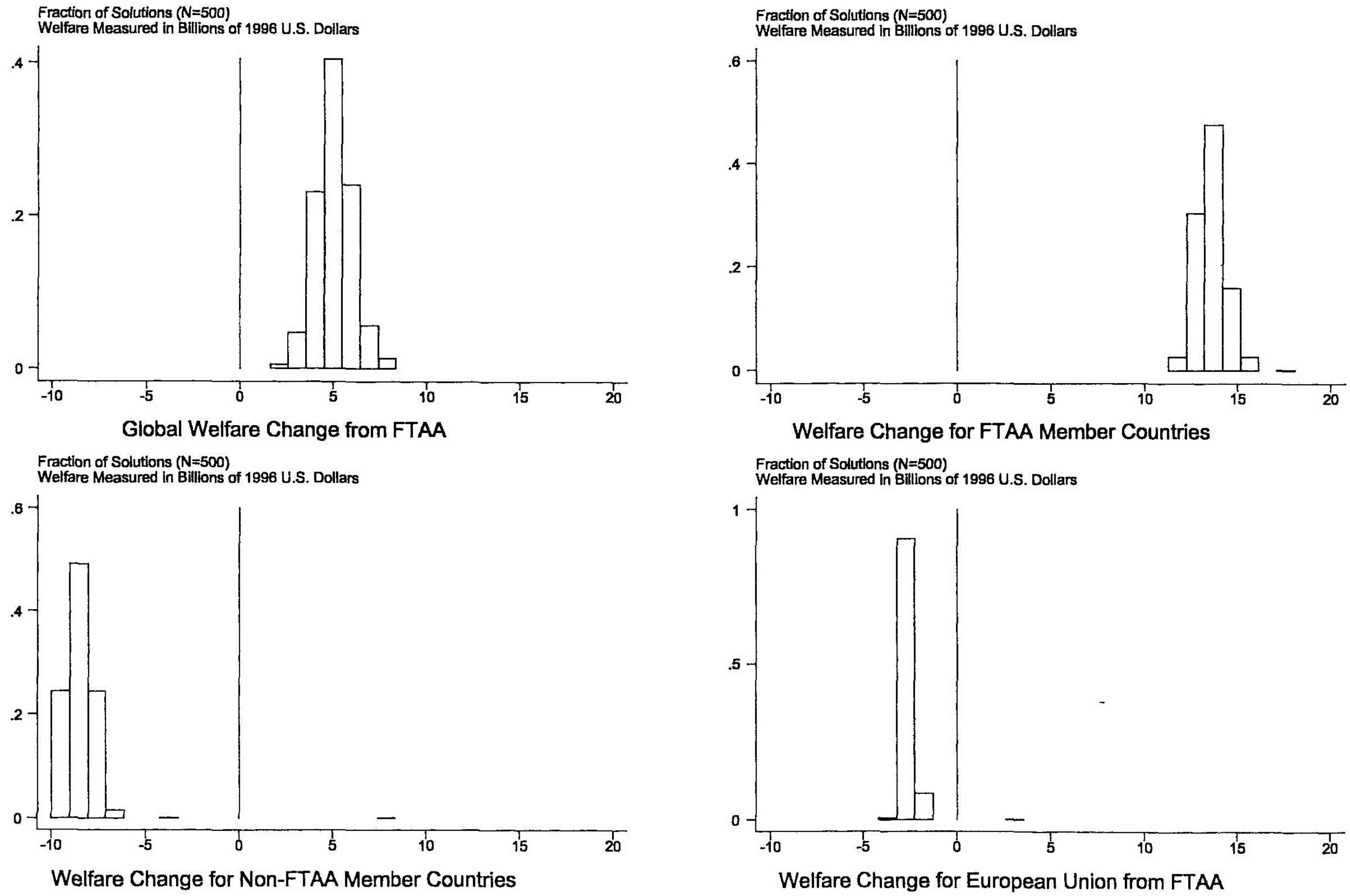

Figure 3: Sensitivity Analysis of FTAA Impact on Global Welfare

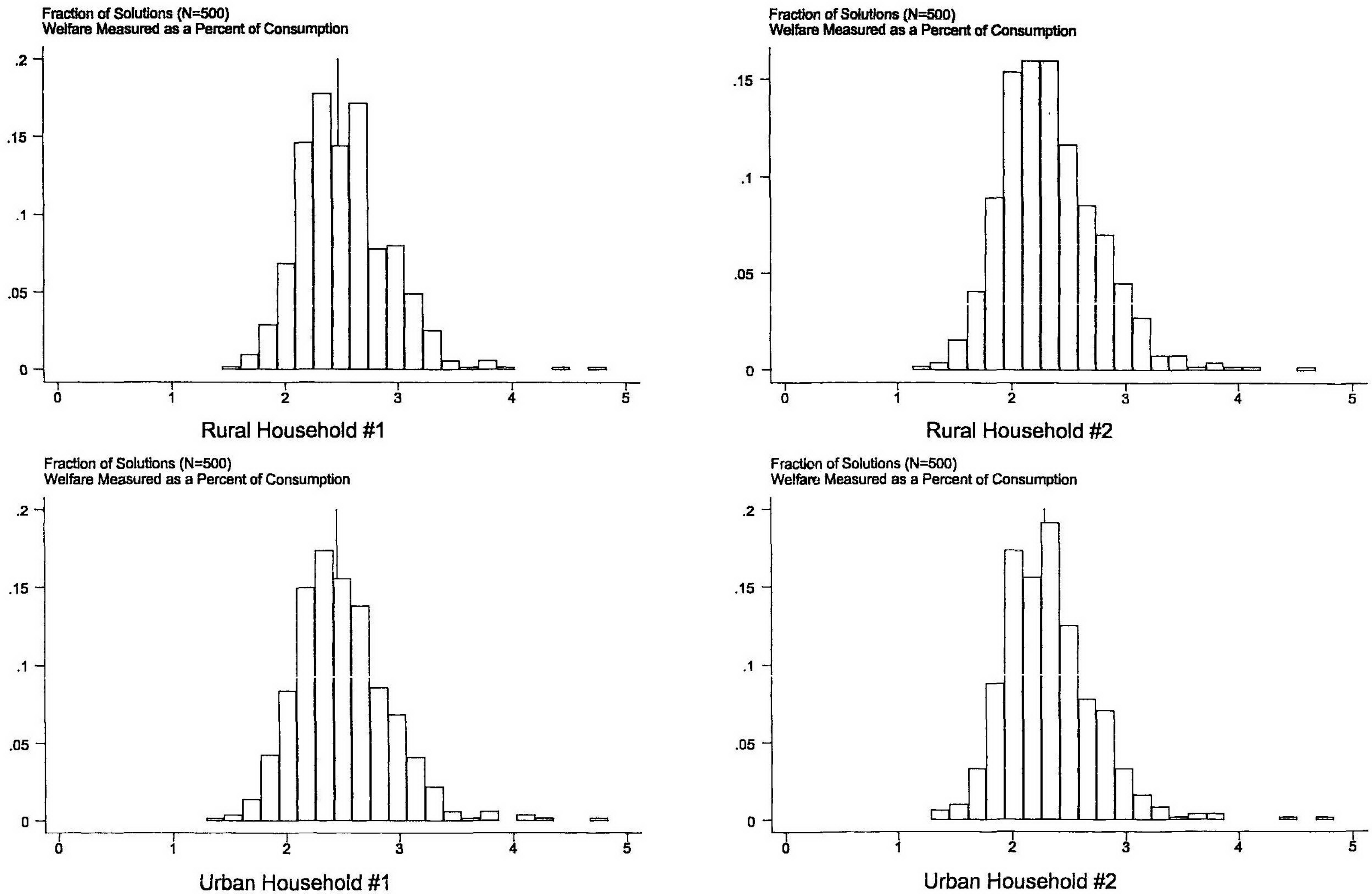

Figure 4: Sensitivity Analysis of FTAA Impact on Poorest Households

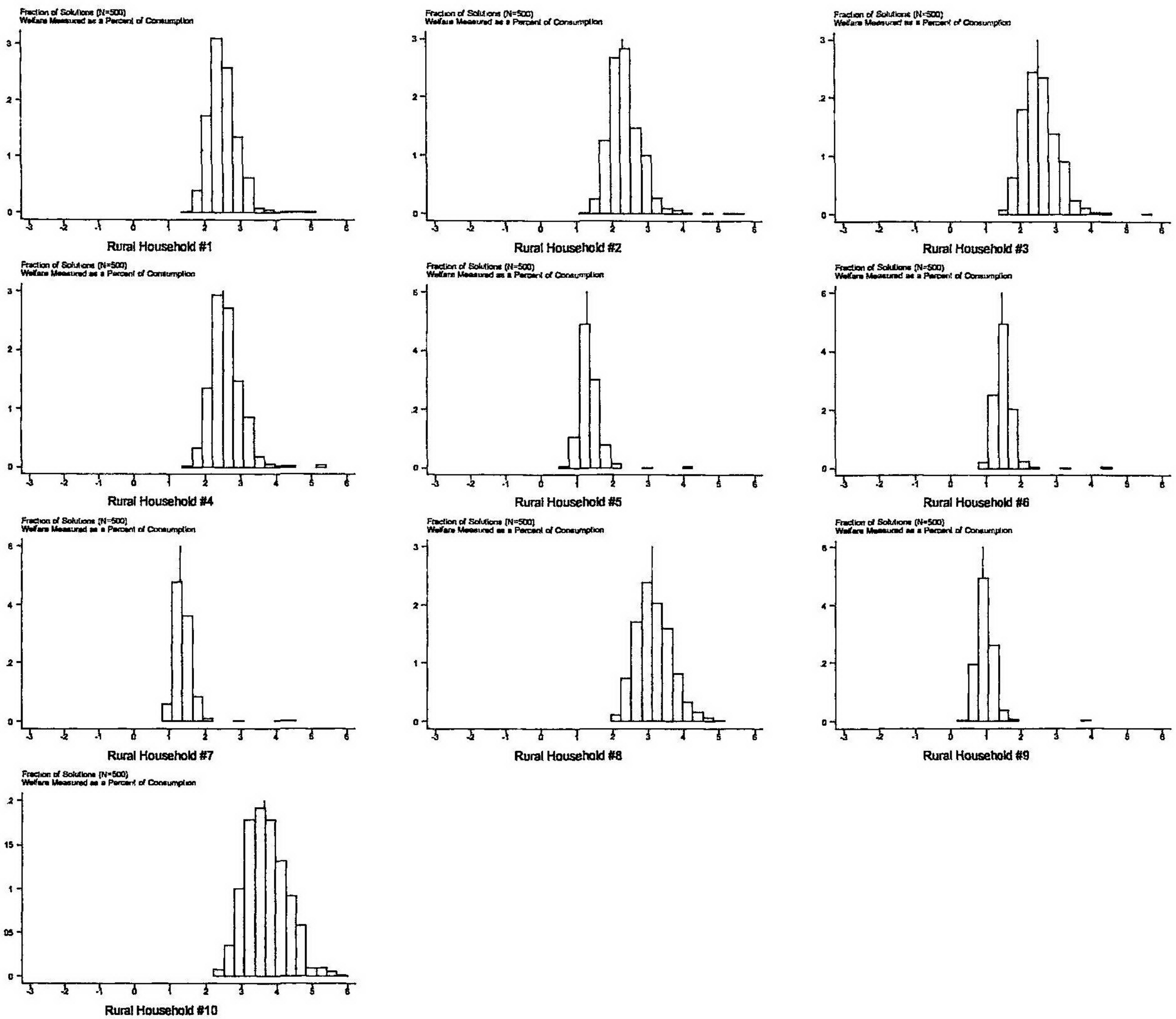

Figure 5: Sensitivity Analysis of FTAA Impact on Rural Households

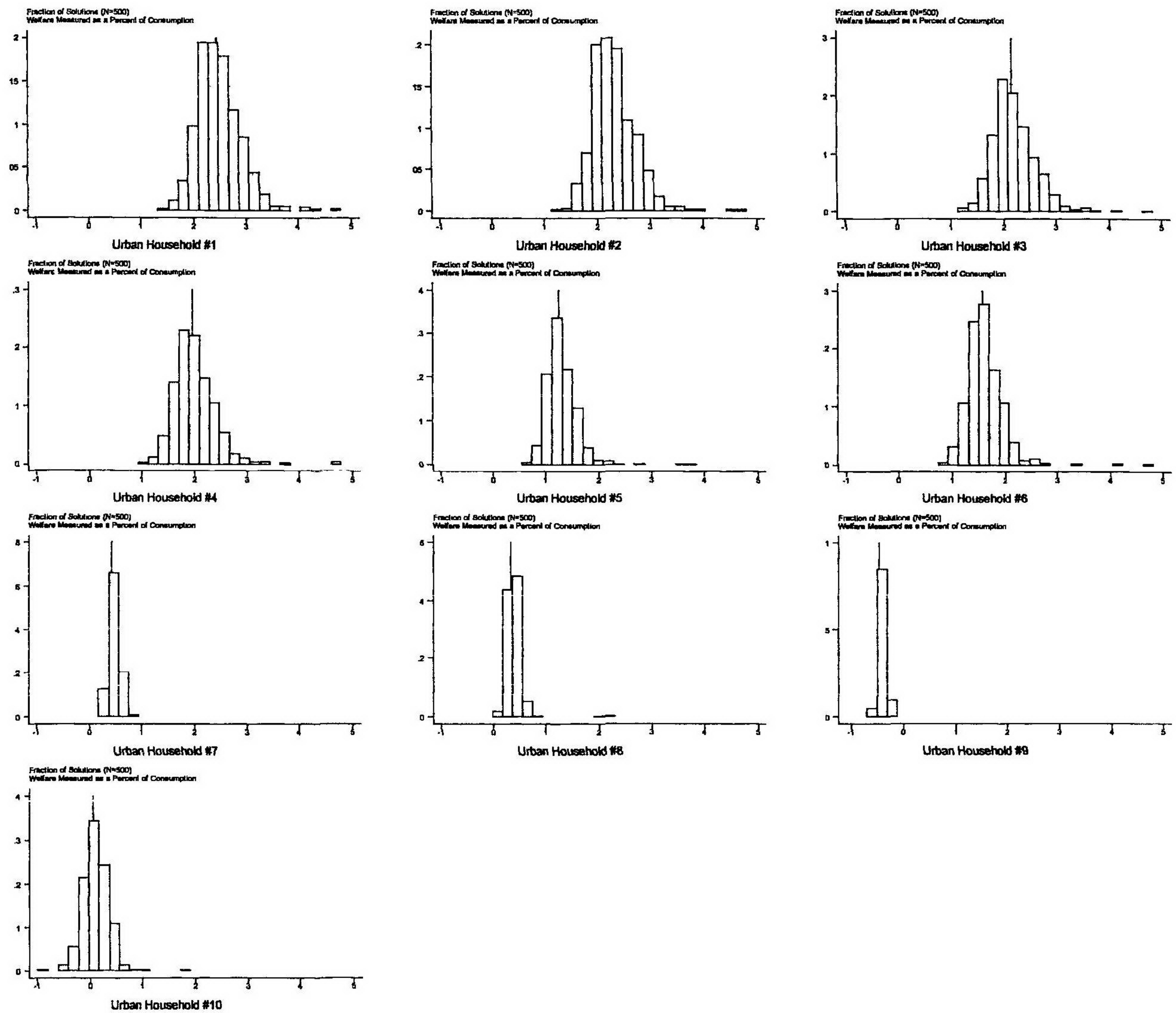

Figure 6: Sensitivity Analysis of FTAA Impact on Urban Households

References for Appendices

Arndt, C., A. Cruz, H. T. Jensen, S. Robinson and F. Tarp, *Social Accounting Matrices for Mozambique 1994 and 1995*, TMD Discussion Paper Series No. 28, Washington D.C.: International Food Policy Research Institute, July 1998.

Hausner, U., *A 1995 Social Accounting Matrix for Zambia*, TMD Discussion Paper Series No. 49, Washington D.C.: International Food Policy Research Institute, September 1999.

Instituto Brasileiro de Geografia e Estatística - IBGE, *1995 Annual Survey of Mining and Manufacturing Industries - PIA*, 2001a, http://www1.ibge.gov.br/english/estatistica/economia/industria/pia/empresas/emp95/.

Instituto Brasileiro de Geografia e Estatística - IBGE, *1995 Annual Survey of the Construction Industry - PAIC*, 2001b, http://www1.ibge.gov.br/english/estatistica/economia/industria/paic/.

Instituto Brasileiro de Geografia e Estatística - IBGE, *Censo Agropecuário 1995-1996*, 2001c, http://www2.ibge.gov.br/ibge/ftp/ftp.php.

Instituto Brasileiro de Geografia e Estatística - IBGE, *Contas Nacionais - Matriz de Insumo produto 1995*, 2001d, http://www2.ibge.gov.br/ibge/ftp/ftp.php.

Instituto Brasileiro de Geografia e Estatística - IBGE, *Pesquisa de Serviços - PAS*, 2001e, http://www1.ibge.gov.br/ibge/estatistica/economia/comercioeservicos/pas/.

Instituto Brasileiro de Geografia e Estatística - IBGE, *Pesquisa Industrial - 1998*, v.17, 1998.

Thomas, M. and M. Bautista, *A 1991 Social Accounting Matrix (SAM) for Zimbabwe*, TMD Discussion Paper Series No. 36, Washington D.C.: International Food Policy Research Institute, January 1999.

Rutherford, T. F. and S. V. Paltsev, "GTAP in GAMS and GTAP-EG: Global Datasets for Economic Research and Illustrative Models", *Working Paper*, University of Colorado Department of Economics, 2000.

Miscellaneous References

file: Import.zip, file: FinPubl.zip (Suplemento estatístico, outubro de MDIC/SECEX, in Banco Central Homepage: http://www.bcb.gov.br1999, Receita do Tesouro Nacional, National Treasury Revenues).

Ministry of Development, Industry and International Trade homepage: http://www.desenvolvimento.gov.br/publica/SECEX/doc/balanca2000/balanca-12-2000/BCB002.doc

Federal Revenue home page: http://www.receita.fazenda.gov.br/

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